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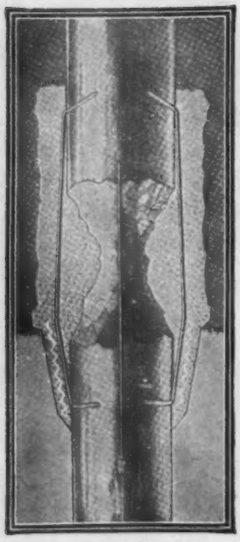

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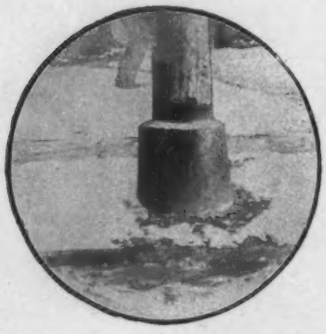

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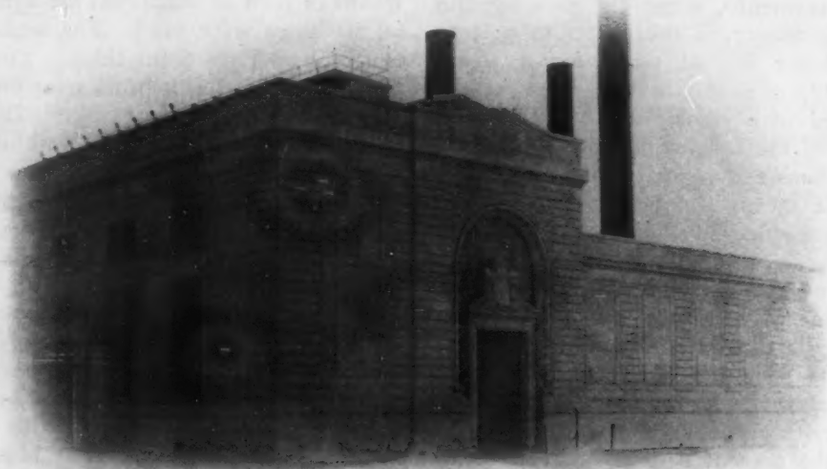


A NEW STEAM AUXILIARY AT SACRAMENTO

BY RUDOLPH W. VAN NORDEN,
Member A. I. E. E., A. S. C. E.

The re-introduction of steam generating plants to operate in conjunction with transmission systems delivering power from mountain streams across great distances to the points where the power is consumed, has been made necessary as these systems have increased in the magnitude of their business and multiplied in an endless intricacy in their transmission networks. The very type of plant which the advent of long transmission made unprofitable and for which it was discarded has been recalled on an even larger scale than of old but for quite a different form of usefulness. It is now an elaborate investment for insurance against service interruption.

The transmission of power at high voltages has attained a degree of perfection which was looked forward to, not without misgivings, less than a decade ago; that is, service interruptions are remote compared to current practice of that time. Still there remains always a possibility of unlooked for occurrences.

The business of supplying power is now so enormous and so many people are dependent on an absolutely continuous service that the auxiliary steam generating plants, at strategic points close to the center of large power markets, are well worth their cost and maintenance, even if they are called on to supply power only in rare emergencies. The auxiliary plant as now constructed is the last word in modern design and equipment and generally of a capacity to carry for a short time the entire load of the district which it serves. It is necessary that it be held ready at any moment to pick up the load and for this reason one generator is always operating on the system, that is, it is "floating," using only enough steam to supply its own inherent losses, but with sufficient boiler capacity under steam for a sudden call.

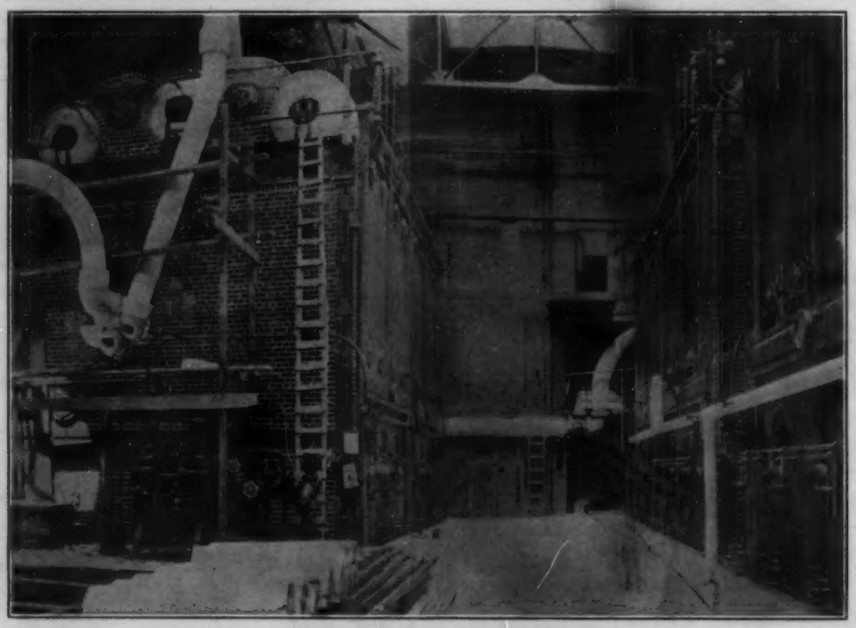
The Pacific Gas & Electric Company with its enormous network, probably the greatest in point of area covered in the world, has eleven hydroelectric plants, with at least six more not under its control with which it operates in parallel and from which it receives power. In addition to this there is now under construction a plant with generating capacity which

will amount to about 50 per cent of the aggregate power of its present hydraulic plants. In the city of San Francisco there are in regular operation great steam plants not used for auxiliary purposes, although the day may not be far distant when it will be possible to hold this machinery as a standby. All of this generating capacity amounting to 200,000 horsepower, supplies a demand which forms an enormous business. The multiplicity of plants and transmission lines is in itself a strong factor in the maintenance of continuous service at all points. But the demand for power is ever increasing and these plants are loaded to their full capacities. This condition notwithstanding the comparative safety, creates the necessity for steam driven reserve installations.

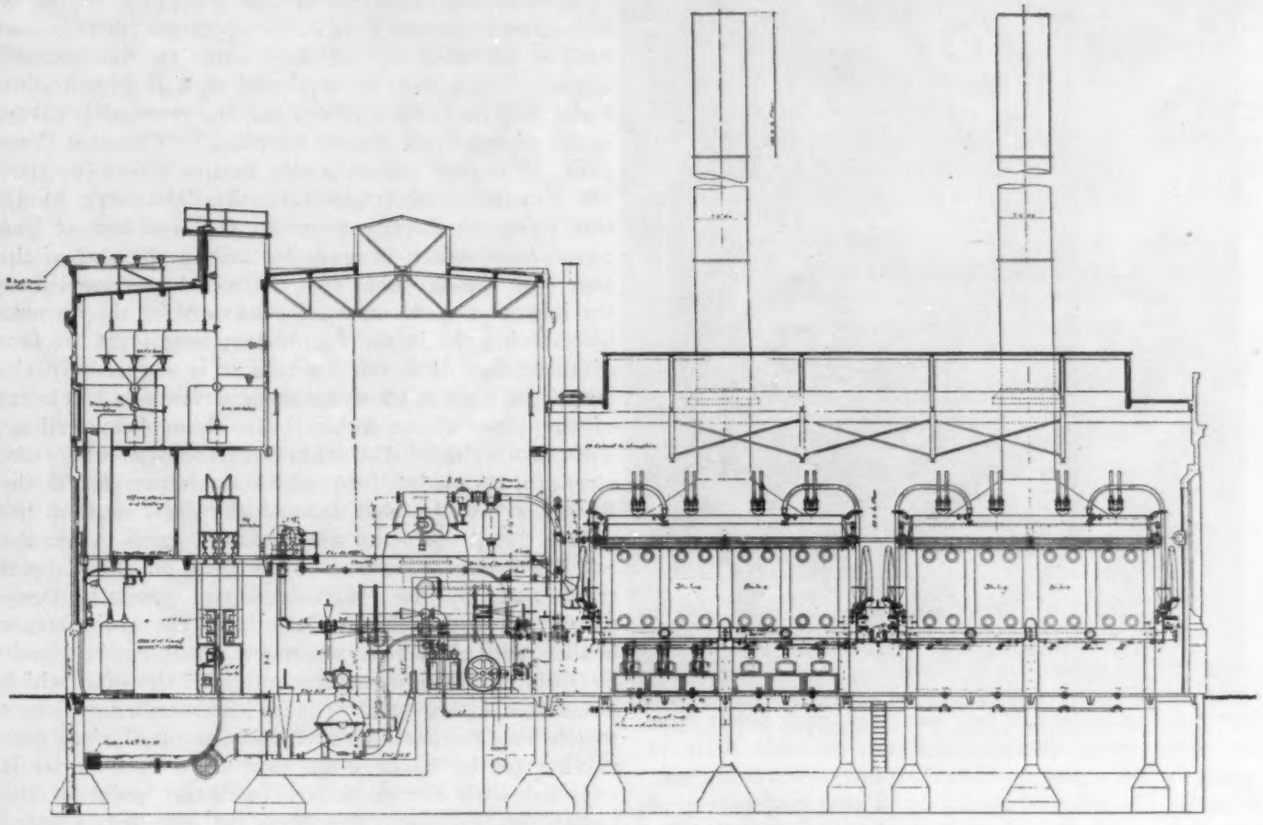
The city of Sacramento, a rapidly growing and very prosperous community, is the center of a large power market and the logical point for a steam auxiliary. This city, one of the very first in the world to be supplied with transmitted power generated by water, one of the first to put the steam central station out of business as an obsolete curiosity, can now boast of a steam generating plant, which for its careful design, splendid equipment and pleasing finish is undoubtedly an example of the best modern practice for the purpose which it is intended.

The plant is situated within the city limits about a quarter of a mile north of the city itself and near the east bank of the Sacramento river. The city is growing rapidly and some day it will surround the plant, or, what is quite probable, a great public park will adjoin it, for the present setting of green fields and river bottom foliage are picturesque in the extreme. At any rate the company has wisely looked into the future and this plant will be an ornament to any community, or even a park. Power plants, especially steam power plants, are often classed in the public mind with mill-hoists, tanneries or boiler shops, and, while there are many notable examples of elaborately designed and executed power plant buildings, care in this regard is by no means always taken. Engineers are coming more and more to the realization that there is greater meaning to the neat appearance and pleasing outline of their plant buildings than the mere esthetic desire for ornamentation. The psychological effect on those who are directly associated with its operation, upon the minds of the public with whom the business of the plant comes in close touch, and upon utilitarian values in the community immediately adjacent is of the greatest importance.

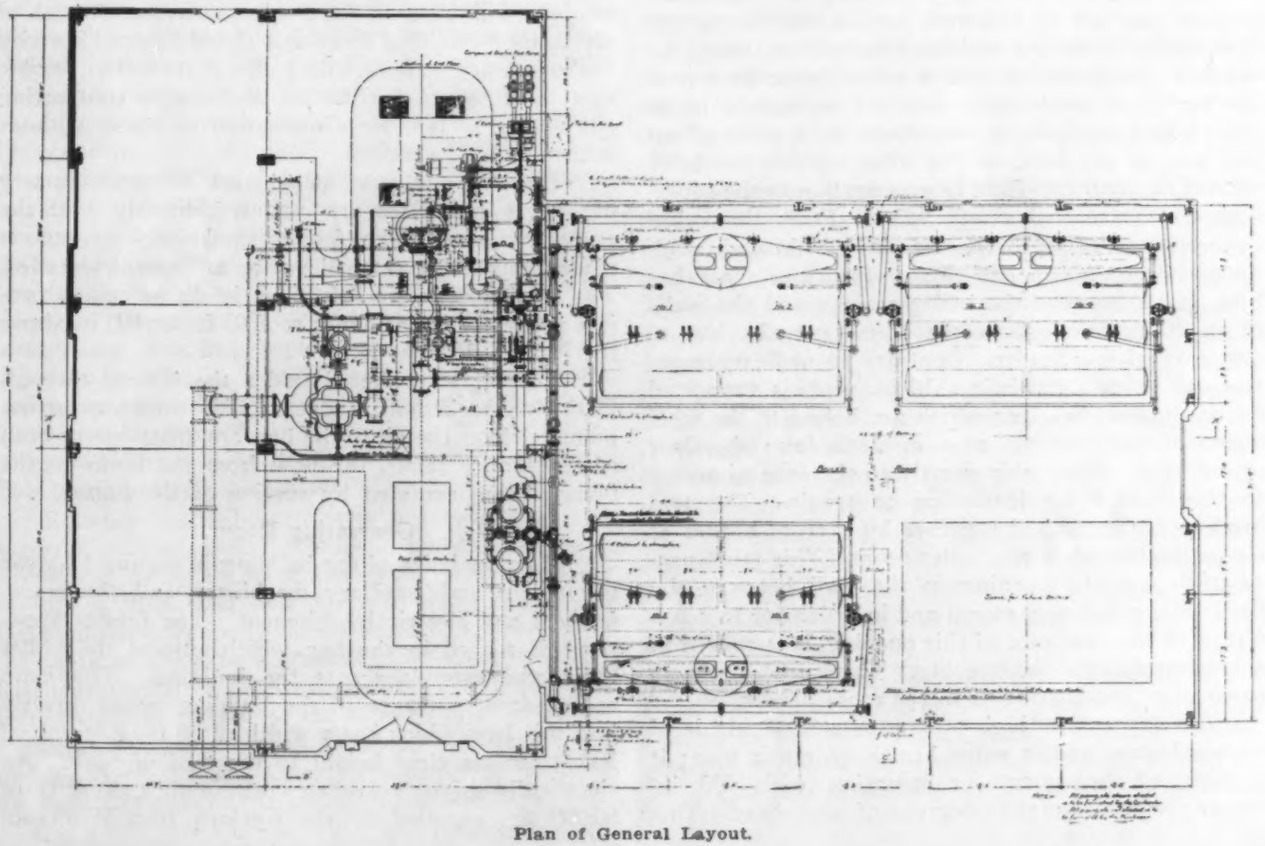
The plant building has a steel frame with Howe roof trusses. It is supported on piles as there is no rock near the surface at this point. Under each column is a block of concrete containing 12 cubic yards which in turn is supported on a cluster of piles. In all 500 piles were used. The walls are of reinforced concrete and are 6 in. thick. The roofs are almost flat and there are monitors over both the boiler room and the generating room bay. The roofs are also of reinforced concrete. The building is in two rectangles, forming an "L." It has a total length of 156 ft. 5 in., a width at the northern end of 100 ft. 6 in., and at the other end of 71 ft. 4 in. The exterior design was furnished by Mr. Willis Polk, an architect in San Francisco. It was the purpose to obtain, with the utmost simplicity, and at cost but a trifle more than the roughest finish, a building which for its classic outline and dignified appearance, would never mar the surrounding landscape, but be a pleasure to look upon. In accomplishing this end, a simple classic design was adopted. The blank walls were paneled in the final plaster coat, symmetry of outline being derived by correct balance with the general structure. The main entrance is heavily moulded and the ornamental arch and cartouche is the only part where any really elaborate finish has been attempted. A cream tinted Santa Cruz white cement plaster finish carefully laid carries out the effect desired and, were it not for the three smokestacks the building



View in Boiler Room, Showing Steam and Oil Piping; Fuel Oil Pumps to Left; Door to Generating Room in Background.



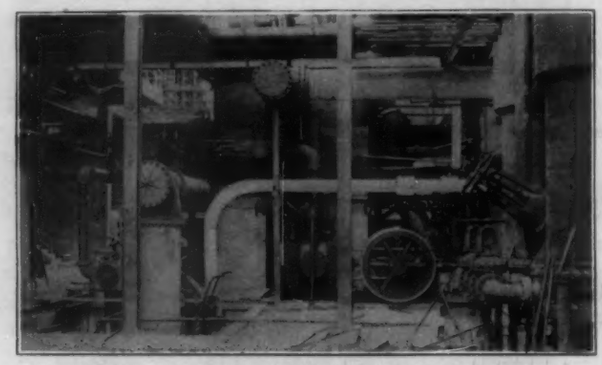
Cross-Sectional Elevation of Plant.



Plan of General Layout.

might be easily mistaken for a gallery of fine arts. At any rate the people of Sacramento have something to be proud of, from the rare beauty of it.

As before stated the interior is in two sections. The boilers occupy the more southerly of these compartments. They are ranged on either side of a center aisle which runs lengthwise of the building toward the generating room. On the east side are



Auxiliary Apparatus on Main Floor. Feed Water Heaters on Extreme Right; Mullen Vacuum Pump in Center; Engine Driven Circulating Pump in Pit at Left; Condenser Behind Concrete Columns in Background.

four Stirling boilers in two batteries, each boiler having three firing doors. On the west side there is space for an equal number but for the present, one battery only will be installed. These boilers are of the water tube type and each contains 600, 3¼ in. steel tubes, three 42 in. drums and one 18 in. mud drum. Each has a capacity of 846 boiler horsepower or a total of 5000 boiler horsepower.

In the general set-up and firing arrangements, modern practice is followed, and in the piping the installation is unique and shows a careful study for modern conditions. Steam is taken from the top of the boiler or steam drum and led through a 10 in. pipe which describes a half-circle, to a point about half-way to the floor, in the space outside the brick wall of the battery. Here is a connection to the superheater, a valve and safety valve. From the valve, connection is made to the header-pipe through a 10-in. pipe formed in a half-circle. Plenty of space has been given between the boiler casings and the walls of the building so that free access may be had to any part of the header. Contrary to ordinary practice the header, which is a 14 in. pipe, is supported on heavy steel brackets which are bolted to the steel frame of the building, at a distance from the floor of only 9 ft. This adds greatly to the ease of access to this header for inspection or repair. The two headers are connected together by a cross header at the northern end of the boiler room. This must necessarily pass the opening in the wall between the boiler and generating rooms and in order not to interfere with the clearance of this opening, it is curved in a semi-circle over the opening. This curve also acts to equalize any expansion in the cross header.

All of the main high pressure steam piping is of wrought steel and is extra heavy hydraulic pipe; it is designed throughout for operation with 200 lb. steam pressure and 150 degrees of superheat. This equipment was supplied by the Pittsburg Piping & Equipment Company. Cast steel valves, fittings and flanges are used for all sizes from two inches and larger. The boilers are equipped with Hughson automatic stop and check valves and the remaining valves in the piping system were supplied by Crane & Company. The high pressure pipe flanges where the sizes are four-inch and larger have the "Pittsburg joint," this being an improvement on the well-known Van Stone joint which is made by rolling the end of the pipe over the flange so that the rolled-over ends form the joint and the flanges are used only for the purpose of clamping the joint. In the Pittsburg joint the face of the flange is beveled where it is covered by the lap of the pipe to allow for the difference in thickness of the pipe where it has been thinned by rolling. This insures the full thickness of the pipe where the strength is needed. In addition the inside of the flange is also beveled toward the face so that the pipe is flared out at an angle of 10 degrees before the end is rolled over the face of the flange. Eclipse steam traps made by the Hughson Steam Specialty Company are used. The outlets from the main steam header and elsewhere wherever possible are made by welding wrought steel nozzles to the pipe which eliminates fittings and reduces the number of joints which would otherwise have to be used. Before connecting to the headers, the pipe from each boiler is supplied with a valve. At the center point of the header on the east side there is installed a valve whereby one-half of this header may be shut-off and there are two valves in the cross header at either end of the curved section.

When the fourth battery of boilers is installed the headers will be connected across the south end of the boiler room, thus forming a closed loop. This with the necessary valves will make a perfectly flexible system of steam distribution and enable the cutting out of any section for examination or repair without interruption to service.

There is one steel smokestack for each battery of boilers and these are mounted directly over the respective sets. The fourth smokestack is not in place as its boiler set will not be at present installed. The smokestacks are 7 ft. 6 in. in diameter and project above the boiler house roof 60 ft., or 100 ft. above the furnace floor.

Fuel oil is delivered under the boilers through Peabody back-shot burners. Worthington steam pumps deliver the oil to the burners, from one or both of the service tanks, the flow from the tanks to the pumps being actuated by suction of the pump.

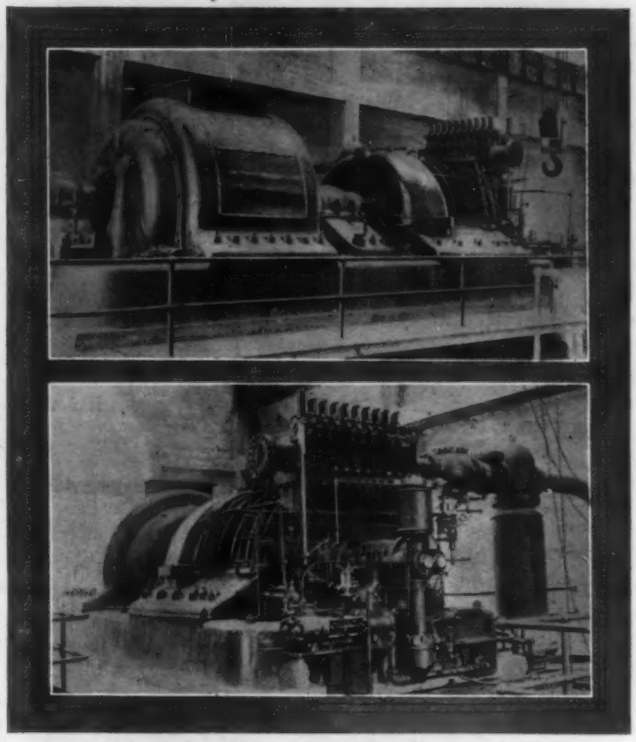
Generating Room.

The remainder of the building is occupied by the generating and auxiliary machinery and the transformers and electrical equipment. The former apparatus is placed in the bay which adjoins the boiler room and extends across the building. The main arched front entrance of the building opens directly into this bay, which has a width of 38 ft., a length of 100 ft., and a clear height to the roof of 52 ft. An electrically driven traveling crane with a capacity of 80,000 lb., supplied by the Cyclops Iron Works of

San Francisco, operates throughout the length of the bay, the rails on which it runs being supported on girders which are carried by the steel columns in the partition with the boiler room on one side and the transverse row of columns which also support the second and third floor galleries, on the other.

Provision has been made in the design of this plant for two main steam generating units, one of which is now installed. These units will rest near the east and west end of the bay and about midway on the floor space. The turbo-generators will be mounted on heavy concrete piers which resemble a table having four legs and are on a level with the second or switch-board floor. The first turbo-generator, which is already installed is a Curtis, horizontal type, five-stage unit. In this turbine, steam is admitted through a series of valves which are automatically operated by the governor and open or close in sequence as the demand for power increases or decreases. The steam is led into the first stage through a series of nozzles in which it is expanded, whereby velocity is gained. This energy is given to the vanes of a series of rotating elements as it passes through them. A second expansion takes place through a second set of nozzles and the next set of vanes receive energy. This performance is repeated until five stages are passed when the steam exhausts at low pressure into the condenser, where the water of condensation is returned into the boiler feed. Directly underneath the turbine and suspended between the legs of the concrete foundation is the condenser. This is of the surface type furnished by the C. H. Wheeler Company and consists of a large steel drum in which are fixed 3000 one-inch brass tubes, giving a cooling surface of 10,000 sq. ft. On the main floor under the condenser are placed two 4 in. hot-well pumps. One of these is driven at 1500 r.p.m. by a Kerr steam turbine, while the other is driven by a 20 h.p., 110 volt direct current interpole motor. Near these sets is a 4 stage, 4 in. Alberger rotary pump direct connected to and driven by an Alberger-Curtis steam turbine operating at 3600 r.p.m. This unit will be in continuous use to supply the feed water to the boilers. There is also a Dow duplex steam pump with cylinders 9x16x7x12 in. for a like purpose, but as the efficiency of this type of apparatus is lower than the turbo-pump, it is to be used as an auxiliary or emergency boiler supply. Near these sets are two Elliott feed water filters. On the opposite side of the turbine foundation there is placed a Mullin, wet-vacuum air-pump, also supplied by the C. H. Wheeler Company. This pump has cylinders 9x16x7x12 in.

Between the turbo-generator piers and placed in a pit, somewhat below the main station floor is a circulating pump. This draws water from the river through a 30 in. cast iron pipe and forces it through the condenser, where by the cooling effect, causes condensation of the exhaust steam. The water with the heat extracted from the steam passes back to the river through a pipe similar to the intake. This unit consists of a 30 in. double feed Byron Jackson centrifugal pump, driven through a flexible leather-link coupling by a quarter-connected American-Ball compound engine. In this engine the high-pressure cylinder is horizontal while the low-pressure is vertical. In connection with this set is a three-throw Byron Jackson plunger vacuum pump for starting and maintaining the suction for the larger centrifugal pump. It is driven at 150 r.p.m. by a 5 h.p. induction motor through gearing.



Main Turbo-Generator Showing Governor Valves, Throttle Valve and Oil Pump.

Connection between the steam header in the boiler room to the turbine is made through a 10 in. pipe which raises from the header, curves in a quarter circle, passing through an opening in the dividing wall to the main steam valve on the turbine.

The above apparatus is standard and similar to that used in many modern stations, but the arrangement is at once simple and get-at-able and the workmanship, particularly on piping, is especially good. Pipes and all surfaces where radiation of heat is undesirable have a magnesia heat insulating covering 3 in. thick.

Boiler feed water and circulating water for use in the condensers is taken from the Sacramento river. A well has been put down to supply water for the boilers in the event that the river water should become too muddy for use.

The intake from the river is unusual. The Sacramento is contained between levees and at periods of high water the surface is nearly on a level with the floor of the plant, while at low water the surface may be 20 ft. lower.

A pier of piling was erected extending from the levee well into the river. The upstream side was slanted to the current and planked so that floating material would be deflected away from the pier. The 30 in. cast iron intake and discharge pipes are carried

underground from the pump pit in the station, through the levee and suspended within the pier. The intake pipe terminates in a flange and head. Extending some distance back the surface of the pipe was turned and to it is fitted a revolving sleeve which carries a "T" outlet. Normally this outlet pipe hangs vertically and at its lower end are a strainer and foot-valve. With the aid of a block and tackle erected on the pier, this intake may be revolved into an upright position for cleaning and inspection. The discharge pipe turns down through a cast iron elbow to a point below lowest water, and then by means of another elbow the opening is made horizontal. The outlet opening is downstream from the intake so that there will be no possibility of the hot discharge getting into the intake.

Oil Supply System.

Fuel oil may be delivered to the plant either by barges coming up the river, or from cars. The former discharge at the pier, the oil being pumped through an 8 in. wrought iron pipe to the storage tanks. There are provided six vertical pipe outlets with valves placed in a line parallel with the railroad track into which oil from cars may be delivered.

Reinforced Concrete Pad for Support of Oil Storage Tank, Under Construction.

The storage tanks are placed in the rear of the power house a distance of 450 ft. Each tank has a capacity of 10,000 bbl. and together they will operate the plant continuously for one month. These tanks are of riveted sheet steel and are 49 ft. 3 in. in diameter and are 30 ft. high. They are mounted on heavy reinforced concrete pads, which extend beyond the sides of the tank walls. Surrounding each tank is a reinforced concrete wall 12 ft. high. This base and wall form an external tank and is for the purpose of holding the oil, should the steel tank fail or the oil get on fire, the capacity of the concrete container being equal to that of the steel tank. There is a waste drain whereby the oil may be carried away in case of disaster.

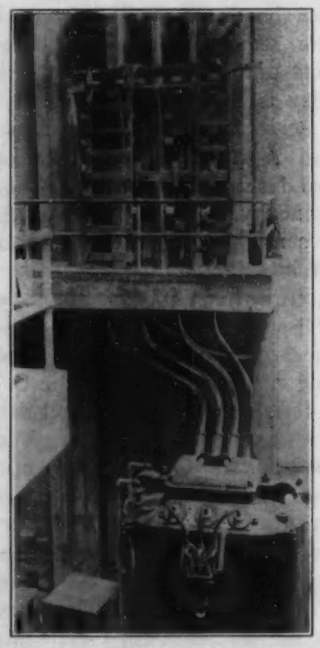
Oil from the tanks is brought to the building through duplicate 8 in. wrought iron pipes. Laid with these pipes is a 2 in. pipe carrying live steam or exhaust for the purpose of heating the oil as it flows from the tanks to the boiler room, and these pipes are all enclosed in a box which is packed with sawdust

There are two rectangular service oil tanks mounted on concrete bases immediately south of the boiler room. These have a capacity of 200 bbl. each.

Pointers are mounted on the wall within the boiler room back of each tank to indicate on brass gauges the quantity of oil within the tanks. By measuring the surface height of oil in a small tank, a much higher degree of accuracy may be obtained than if the measurements were made in the storage tanks.

Electrical Equipment.

The transformer and switch equipment is placed on three floors, including the main station floor, and occupies the space between the engine room bay and the north wall of the building. There are six 1500 kilowatt General Electric transformers, placed in a row close to the north wall on the main floor, these are oil-immersed and water cooled and are wound for a voltage ratio of 31,215-54,000 Y on the high tension side and 11,250-19,500 Y on the low tension side. The



Three-Phase Generator Transformer and Reactance, Showing Brass Tube Conduits.

high tension wiring is supported on 4 part insulators mounted on pipe framework. There is space for three additional transformers.

Directly in front of the transformers and arranged in a row are the two 11,000 volt station bus lines, meter transformers and disconnectors. These are mounted in 3 in. concrete compartments, the busses being arranged vertically, front and back and the various transformers underneath.

In one corner are placed three 100 kw. service transformers for lighting and power in and about the station.

On the main floor at the east end of the generating bay is a three-phase, 5000 kw. oil immersed and water cooled transformer which serves the double purpose of a reactance in the generator circuit and also to transform from the 4000 volt generator current to 11,000 volts for paralleling into the bus lines. It is necessary to obviate the damage which would be caused by the flow of excessive current in the generator circuit in case of a short circuit, to interpose

The Switchboard. Turbo-Exciter on Right.

General View of Switchboard Gallery. Switchboard on Left; Switch Cells in Rear; Turbo-Exciter in Right Foreground.

a reactance. The cost of this reactance and the extra cost of a generator wound for 11,000 volts, overbalances the cost of a raising transformer designed to take the place of a reactance coil. The leads to this transformer are brought from above through 3 in. brass ducts. In this particular instance, the construction which is exposed and noticeable has been done in an exceptionally neat and artistic manner.

Communication between the main and upper floors is had by a wide steel and concrete staircase placed within the northeast corner of the building.

The second or switchboard floor is on a level with the base of the turbo-generator, it is carried beyond the columns into the bay and is continued across the bay and around the turbo-unit as a steel plate structure mounted on light steel framework supported from below on steel columns.

The exciters are placed on this floor occupying spaces between the building columns at either end of the switchboard. The exciter set at the right of the switchboard consists of a six-pole interpole 75 kw. 125 volt, direct current generator, driven at 3300 r.p.m. by a Curtis non-condensing steam turbine using steam at 175 lb. pressure. The other exciter unit is a 100 kw. interpole direct current, 125 volt generator driven through a rigid coupling by a Fort Wayne 150 h.p. 3-phase, 220 volt, induction motor, at a speed of 870 r.p.m. This unit has but three bearings, two on the motor and an outboard bearing on the generator and is mounted on a cast iron base.

The switchboard has the form of the arc of a circle and is placed well out in the bay and between the two main generating units. The curved form is adopted for two purposes; the first, giving ample space in the rear of the end panels which would otherwise be obstructed by the building columns, while the second allows the operator to observe the instruments on all of the panels more easily without changing position and also makes observation at a distance easier.

There are nine ebony asbestos-lumber panels composing the switchboard and these control the two main generators, the exciters, four high tension circuits, and two local circuits. The instruments are General Electric and Westinghouse round type and the switch control all of the remote type for motor operation.

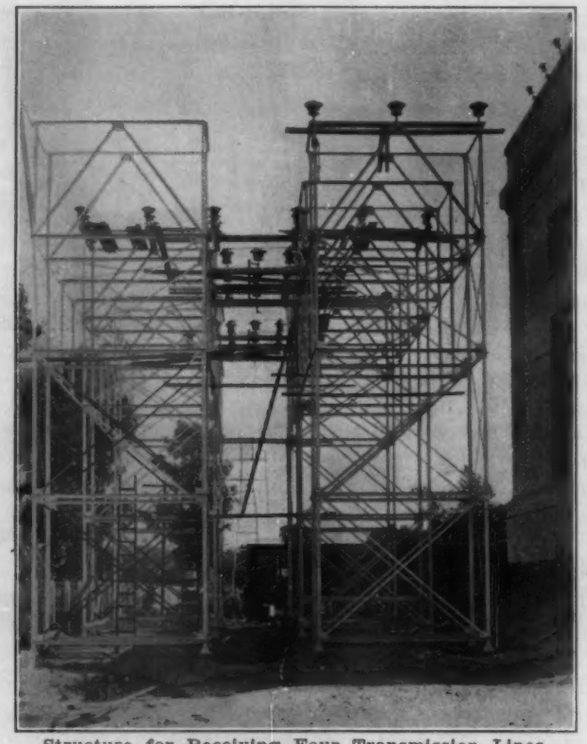
Facing the switchboard, and placed against the south wall of the generating room is a triangular board supporting steam, first stage pressure, and vacuum gauges and an electric (voltmeter type) speed indicator. On either side of this board are two Hohman & Mauer mercury columns for accurate vacuum measurements.

In the rear of the switchboard, arranged in two rows of 12 each, their cells being back to back, are the 11,000 volt, type H-3 General Electric, motor-operated circuit-breakers. This arrangement in two rows make possible duplicate sets with connection from below to the two bus lines, and these pairs control the circuits from the two turbines, three sets of transformers, six feeder circuits and a house circuit. At the east end of this floor or gallery, is a concrete switch cell containing two 4000 volt three-pole type H-3 circuit breakers on the main generator leads and near these is a compartment directly over the compensator transformer, containing disconnectors and series and shunt transformers for supplying the generator switchboard instruments.

To the rear of the 11,000 volt switch cells and extending across the north end of the building are a series of rooms containing a lavatory and shower bath, a locker room, store room, foreman's office, etc.

The third floor is not open to the generator bay. This floor contains the 60,000 volt oil circuit breakers. These are of the horizontal four-break type manufactured by this company. Each set of three switches is mounted on the floor and has its own concrete cell. There are 6 sets and they are arranged in two rows along the north and south wall of the room. The three high tension circuits from their respective circuit-breakers to the transformers on the first floor are led down through the rooms on the second floor gal-

Rotary, 60,000 Volt Disconnecting Switches on Roof and Double Windows for Entrance of High Tension Lines.



Structure for Receiving Four Transmission Lines With Sectionalizing Disconnecting Switches. Transmission Tower in Background.

lery in reinforced concrete tubes, having a clear inside diameter of 3 ft. These tubes, 9 in all, are built of expanded sheet metal and are plastered inside and out with cement plaster until they have a thickness of 3 in. At their upper ends they extend 2 ft. above the switch-room floor to prevent the possibility of oil from the circuit-breakers which may have leaked onto the floor from running down the tubes.

A high-tension bus is supported from the roof on suspension type insulators, and has disconnectors at the center point.

The outgoing (or incoming) 60,000 volt lines are brought from their circuit-breakers through bar disconnectors into a closed monitor which rises above the roof and from this the lines pass horizontally through circular openings 6 in. in diameter in double glass windows, the sashes of which are 3 ft. x 4 ft., to Baum type, horizontal, two-break, rotary disconnecting switches, mounted on steel structural framework which in turn is fastened to the roof.

A somewhat intricate high tension switching arrangement is made necessary at this plant. There are converging at this point, three transmission lines from three of the hydroelectric generating plants of the system, Colgate, Alta and Folsom, and a fourth line which is a tie-line to the main transmission between Colgate and Oakland at Davis. As all of these points named except Folsom, are connected through other lines in the network, the number of combinations, either in distributing the load or in the supply in case of emergency are considerable, while the Sacramento supply at all times is controlled through this station.

For the present the local distributing station in Sacramento for railway, light, local power and street service will be maintained, the new plant acting only as a reserve steam station and a sectionalizing point for high tension switching.

COST OF CONCRETE LININGS FOR CANALS.

BY B. A. ETCHEVERRY.[1]

All irrigators are well acquainted with the fact that the losses in conveying water in earth canals are in many cases very large and with newly excavated canals are often so great that it is difficult to deliver water at the lower end. On irrigation systems with unlined canals these losses usually range from 25 to 60 per cent of the water diverted and taken in the canal system, and there are many instances where the losses are much greater. In two miles of canal of the Canyon Creek Irrigation Company, near Kelowna, the losses amounted to 60 per cent of the water entering the canal. This is not an exceptional case for in some California canals losses of 64 per cent per mile have been observed. It is safe to state that on an irrigation system consisting of earth ditches, only 50 per cent of the water diverted is delivered to the fields.

Extent of Seepage Losses in Canals.

The extent of seepage losses depends on many factors such as porosity of the soil, the form of cross section, the size of the canal, the number of seasons the canal has been operated, the amount of silt in the water, the velocity of flow, the depth to the water table, etc.

The most valuable general observations as regards the amount of these losses are those of the Irrigation Investigations Office of the United States Department of Agriculture. From series of measurements on seventy-three ditches in the Western states, they have found that the average loss per mile of ditch is 5.77 per cent of the entire flow; the measurements range from a maximum of 64 per cent per mile to a slight gain in a few cases. Large canals in general lose less in proportion than small ones. The measurements show that the loss per mile averages about 1 per cent for canals carrying 100 cu. ft. per second or more, about 2½ per cent for canals carrying 50 to 100 cu. ft. per second, 4½ per cent for canals carrying 25 to 50 cu. ft. per second, and 11¼ per cent for canals carrying less than 25 cu. ft. per second.

For some purposes it is preferable to know the extent of seepage expressed in cu. ft. of water per day per sq. ft. of wetted area of the canal. This is equivalent to stating the depth of water in feet lost each day. A number of measurements have been made in various parts of the country and some of these have been assembled by F. W. Hanna, project engineer of Boise U. S. Reclamation Service Project, in Idaho, who states that from careful consideration of the data assembled, it would appear that a seepage loss of 0.5, 1 and 1.5 cu. ft. per sq. ft. wetted surface per day might be assumed for canal losses respectively for rather impervious, mediumly pervious and rather pervious soils. Based on the above figures and assuming a common form of cross section, he obtains the following results as the seepage loss per mile expressed as per cent of flow.

[1]Head of Department of Irrigation, University of California

Capacity of canal.	Loss in per cent. of flow per mile.		
Cubic feet per sec.	For rather impervious soil.	Mediumly pervious soil.	Rather pervious soil.
10 or less	4	8	12
11 to 25	2.5	4.5	7
26 to 50	1.5	3.	4.5
51 to 75	1.	2.	3.
76 to 100	.75	1.5	2.5

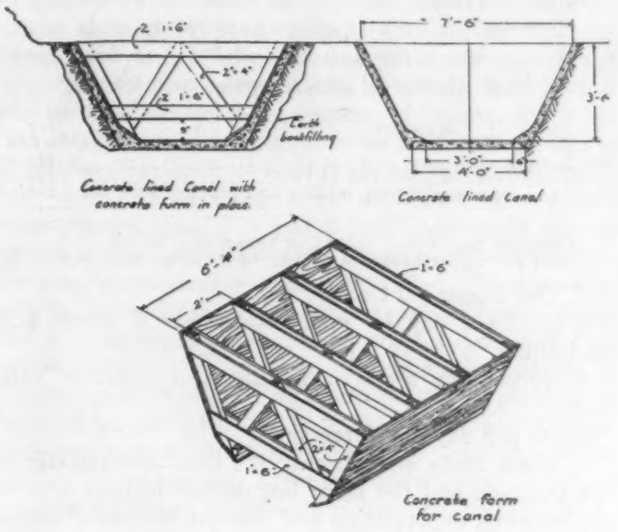
The above table gives results which agree with those obtained by the Irrigation Investigations Office as closely as can be expected because of the numerous factors involved.

Evaporation Loss from Water Surface of Canals.

The losses above stated include seepage and evaporation, but contrary to general belief, the losses of evaporation from flowing water in a canal are insignificant when compared with those of seepage. It has been shown that the losses of seepage and evaporation per day might be assumed at 0.5, 1 and 1.5 cu. ft. of water per sq. ft. of wetted surface respectively for rather impervious mediumly pervious and rather pervious soil. These are equivalent to losses of water 6, 12 and 18 in. deep. As compared to these figures, the evaporation from water surface for the irrigation season will generally be about ¼ of on in. per day, which is from 25 to 75 times less than the above seepage losses. Seepage and evaporation measurements made at Twin Falls, Idaho, and reported by Elias Nelson (Bulletin 58, University of Idaho) show that the evaporation ranged from less than 1 per cent to less than 2 per cent of the total loss in the canals. On one of the largest systems in the San Joaquin Valley, California, the total length of canals is 165 miles and the total seepage loss was 28 per cent and 30 times greater than the evaporation loss. These and other numerous experiments show that the evaporation losses in the conveyance of water are so small as compared with the seepage losses that they are of no importance.

Concrete Linings.

The earliest use of concrete linings was in southern California about 1880 when the increasing value of water made it necessary to do away with losses. Since that time practically all of their canals, which are comparatively small, carrying less than 100 cu. ft. per second, have been lined with concrete and in some cases replaced with concrete pipes. Until recently very little concrete lining had been done outside of that region, but during the last few years concrete lined canals have been constructed on many of the projects of the United States Reclamation Service and on numerous private projects. There are now several examples in California, Oregon, Nevada, Washington, Idaho and other states and during the past two years some excellent work has been done in British Columbia. The Fruitlands Irrigation and Power Company near Kamloops has lined about 6 miles of its main canal which averages 3½ ft. in depth, 4 ft. wide at the bottom and 7½ ft. wide at the top, with an average thickness of concrete of 3 in. and when the system is completed there will be about 15 miles of concrete lined canal. The Kelowna Company has lined the upper 5 miles of its main canal, 2½ ft. deep, 3 ft. wide at the bottom, and 5½ ft. wide at the top, with 3 in. of concrete. The remaining 7 miles of the canal, which is 1.5 ft. deep, 2 ft. wide at the bottom and 4½ ft. wide at the top, is lined with 2 in. of concrete.



METHOD OF CONCRETE-LINING CANALS WITH FORMS AS USED BY FRUITLANDS IRRIGATION AND POWER CO., LTD

Effect of Frost.

Frost should have no effect on the lining if the soil is well drained. But when the soil contains water, freezing will produce heaving of the soil which will not be resisted even by thicker linings than those recommended. Usually a canal which must be lined is located where the water drains too readily from the soil but if the canal is located where water is liable to collect behind the lining, a drain should be provided. The drain should be a 3 or 4 in. tile placed below the floor of the canal lining in a trench 12 in. deep, located along the center line of the canal and the tile covered preferably with loose rock gravel, sand, or other porous material. To discharge the water collected cross drains should be placed every 400 or 500 ft. or wherever there is a drainage channel. The tile may be omitted and the trench filled entirely with rock or gravel but this is not as efficient.

Cost of Concrete Linings.

The cost of concrete lining varies a great deal with the accessibility of the canal the material through which the canal is cut, the planning of the work, the efficiency of the construction force, the price of labor and material.

The cost of lining with forms is given by the following examples:

The Anaheim Union Water Company of Southern California, which has many miles of concrete lined canal, obtained the following unit cost for 1000 ft. of a canal 9 ft. wide at the top, 6 ft. wide at the bottom and 3 ft. deep, lined with average thickness of concrete of about 3 to 3½ in., with the corner at the bottom made thicker.

Material	Cost per 1000 feet.
170 barrels of cement at $2.70	$ 460.00
170 cubic yards of gravel at 65c	110.00
Labor of backfilling using earth form	254.00
Labor of placing with concrete form	212.00
	$1,036.00

Cost per lineal foot, including backfilling, $1.036.
Cost per square foot, including backfilling, $0.0818.

For 4070 ft. of a smaller canal 2½ ft. wide at the top 1 ft. wide at the bottom and 1½ feet deep, lined with 2 in. thickness of concrete, the cost was:

Material.	Total cost for 4070 feet.
180 barrels of cement at $2.40	$ 432.00
180 cubic yards of gravel at $1.25	225.00
Total labor for backfilling, mixing and placing concrete	270.06
	$ 927.06

Cost per lineal foot, including backfilling, $0.228.
Cost per square foot, including backfilling, $0.0526.

The wages paid were:

$1.75 per day for men using earth form and backfilling.

$2.00 per day for men mixing and placing concrete.

$3.00 per day for foreman.

These costs include only the cost of materials in the concrete and the labor but do not include cost of engineering, depreciation and interest on cost of forms and plant. These items would be small for the work was done under the supervision of the superintendent of the company who is paid largely for other duties, and the cost of forms and plant was small. The wages and cost of cement are low and the canal was easily accessible, making the cost of lining lower than could be obtained in British Columbia.

On the system of the Fruitlands Irrigation & Power Company, near Kamloops, the cost of lining 12,000 ft. of canal 4 ft. wide at the bottom, 3½ ft. deep, and 7½ ft. wide at the top with 3 in. of concrete averaged as follows:

Hauling forms, placing forms, backfilling with earth forms	$ .18	per lineal foot
Cost of cement	.50	per lineal foot
Cost of sand and gravel	.16	per lineal foot
Cost of placing concrete forms, mixing and placing concrete	.30	per lineal foot
Gasoline for concrete mixers	.01	per lineal foot
	$1.25	

Cost per lineal foot, including backfilling, $1.25.
Cost per square foot, including backfilling, $0.105.

The concrete used was a mixture of 1 part of cement to 3 of sand and 4 of gravel. The cement cost $3.40 delivered on the job. The above cost was obtained where the canal was easily accessible along the foothills and the forms and concrete mixer could be easily moved along the banks of the canal. The cost of engineering ,administration, interest and depreciation on cost of plant are not included in the cost.

On several thousand feet of canal where the canal was excavated on a steep rocky side hill, it was very difficult to deliver the concrete and the total cost of the above items was $1.72 per lineal foot or 14½ cents per sq. ft.

On the system of the Kelowna Irrigation Company, which has about 12 miles of lined canal, no separate form was used for backfilling the earth; instead metal plates were held away from the concrete forms by studding of the thickness of the concrete inserted between concrete forms and the plate as described above. The cost of lining 24,000 ft. of main canal, 3 ft. wide at the bottom, 2½ ft. deep, and 5½ ft. wide at the top gave the following average cost:

Making rock drain below floor, hauling forms, placing forms and backfilling	$ .21	per lineal foot
Cost of cement and hydrated lime	.47	per lineal foot
Cost of sand and crushed rock	.16	per lineal foot
Mixing and placing concrete	.49	per lineal foot
Miscellaneous	.03	per lineal foot
Cost per lineal foot	$1.36	
Cost per square foot	.158	

The concrete was a mixture of 1 part of cement to 3 of sand and 5 of crushed rock. Cement cost $3.20 to $4.10 delivered. The wages were $2.75 per day of 10 hours for common labor and $3.50 to $5.00 for skilled labor. The cost of engineering, which included location of the canal and the cost of depreciation and superintendence, brought the total cost to 17.73 cents per sq. ft. As the cost of lining only is considered here the cost of location should not be added. The higher cost per sq. ft. obtained in this case was due to the higher cost of cement, the necessity for building roads to deliver material and move forms and mixer along the canal and to the placing of a rock drain under the floor of the canal. It was also necessary to rush the work and this probably increased the cost.

Cost of Lining Without Forms.

The main canal on the Gage Canal system near Riverside, California, has a bottom width which varies from 5 to 10 ft. and a depth from 3½ to 4 ft. and side slopes of 1 to 1. The contract cost for trimming the canal and placing the lining of cement mortar ¾ to 1 in. thick was from 3¾ to 4 cents per sq. ft. This work, however, was done many years ago when labor was cheaper.

The Burbank Power & Water Company of Washington has recently lined 4,100 ft. of the main canal which has a bottom width of 6 ft. 6 in., a depth of 2½ ft. and a top width of 14 ft. The lining is 2½ in. thick for the bottom and 3 in. thick for the sides. At the top of the sides the lining extends horizontally for 6 in. to form a coping. The concrete was mixed in the proportion of 1 part of cement to 2 of sand and 4 of gravel. The lining was finished by painting with a thin mixture of 1 part of cement to 1 of sand. The contract price was $12.50 a cu. yd. or about 11½ cents a sq. ft.

The U. S. Reclamation Service has lined 6 miles of the Main South Side Canal on the Boise Project in Idaho, with a concrete lining 4 in. thick. The canal is 40 ft. wide at the bottom, 8 ft. deep and 64 ft. wide at the top. The concrete mixture was 1 part of cement to 3 of sand and 6 of gravel. A finishing coat of cement mortar was floated over the concrete to give it a smooth surface. The work was done at a cost of a little less than 10 cents a sq. ft. excluding the cost of preparing the foundation.

These and many other examples show that for either method of construction and with average conditions and average prices, a concrete lining 3 in. thick would cost from 10 to 15 cents, including cost of backfilling or trimming the ditch to prepare it for the concrete lining and all cost of engineering, depreciation and interest on the equipment necessary for the work. A concrete lining 2 in. thick should cost from 7 to 12 cents. The lower cost in each case should be obtained with very favorable conditions.

THE JUSTIFICATION OF A RATE.[1]

BY D. C. BARNES.

In order to be justifiable, a rate must conform to the fundamental principle underlying rate making for public utilities which is expressed in the following decision, Smyth vs. Ames, 169 U. S. 546: "What the company is entitled to ask is a fair return upon the value of that which it employs for the public convenience. On the other hand, what the public is entitled to demand is that no more be exacted from it * * * * than the services required by it are reasonably worth." Many scientific rates have been devised for this purpose, which are unnecessarily complicated, involving expensive records and bookkeeping, but which on analysis do not accomplish the accurate assessment of costs for which they are designed, and have in addition the disadvantage of being so involved that the public cannot understand them and hence regard them with suspicion. Rates for electric service should have as simple a form as is consistent with a fair charge for the services rendered.

The customers of an electric plant can be considered under two classes: First, competitive customers; second, non-competitive customers. Competitive customers are those who are not dependent upon the electric plant for their supply of light or power, but may economically obtain their requirements from some other source. Their business should be sought at rates sufficiently high to yield the electric plant a profit on its additional costs to supply them, and sufficiently low to secure for the electric plant the maximum profit obtainable from this class of business. The only obligation of a public service corporation in establishing rates for this class of customers is that the charges shall be the same to all who require service in similar quantity and under similar conditions. This class includes power customers who can supply their requirements by steam or other power, and lighting customers large enough to make the installation of a private plant feasible. The business of such customers is exceedingly desirable if it can be obtained at a profit over the specific expenses incurred in supplying them, for the profit so obtained can be used to lessen the cost of service to the other class of customers. This has been the experience and practice throughout the industry.

The non-competitive customers consist of those customers who can obtain their supply of electricity by no other practical means than through the central station. The rates charged these customers should be such as to yield earnings which, when credited with the profit from competitive consumers, should be sufficient to pay operating expenses incurred in this class of service, taxes, depreciation and a reasonable return on the fair value of the property actually used for their convenience. On the other hand, the charge to each customer should not be more than the service required is reasonably worth to him.

What electric service for lighting is reasonably worth can be shown only by comparison with the cost of lighting (1) by other artificial means of illumination and a comparison of the relative advantages, and (2) by a comparison with the cost of electricity for the same purpose in other localities.

The cost of service in an electric plant differs from that of almost any other industry. Since the storage of electricity in large quantities is not commercially practicable, its product must be manufactured and delivered instantaneously upon demand. Thus a large portion of the cost of service consists of the "readiness to serve" cost which is fixed and is not a function of the quantity of electricity used. Hence, electric service cannot be sold with justice at a uniform flat price as is done in the water and gas industries. These fixed costs may be analyzed into two classes, one a demand cost, dependent on the greatest quantity required at any time from the plant, or the "maximum demand," so called. This cost includes such items as management expenses, insurance, legal expenses, etc. The other a consumer cost, dependent on the number of consumers, which includes such items as maintenance and operation of meters, of arc lamps, of pole lines, renewals of incandescent lamps, clerk hire, etc. In addition to the above the remaining expenses, which may be termed output expenses, are those proportional to the amount of electricity used, and consist of manufacturing expenses, such as coal, water, etc.

It is obviously desirable to have rates for electricity which shall apportion to each individual the cost of his service as closely as practicable. This has been attempted in many forms or rates with varying success. The most common forms in use are:

1. Block System, of which the following rate is an example, namely:

First 20 kw.hr. per month at	11c
Second 20 kw.-hr. per month at	10c
Third 20 kw.-hr. per month at	9c
All over 60 kw.-hr. per month at	8c

2. Wright System, where the charge for current decreases with the number of hours use of the demand or estimated demand, thus:

"13c per kw.-hr. for the first 30 hours use per month of the active connected load.

"9c per kw.-hr. for the next 60 hours use per month of the active connected load.

"5c per kw.-hr. for all additional current consumed."

This is the form of rate adopted by the Wisconsin Commission.

3. Hopkinson System, which consists of a fixed charge based on demand, or size of installation, in addition to a current charge, with quantity discounts increasing with the service charge to allow for decreased costs in supplying larger services.

4. Three Charge System, a further refinement of the above, dividing the fixed charge in two parts to cover (1) demand cost and (2) consumer cost, with a similar current charge to cover cost of manufacture or output cost.

The two latter rates are more scientific than the first two but have certain disadvantages in practical application. The method of determining the maximum demand is either by the use of maximum demand meters or by the assumption of an arbitrary percentage of the connected load for various classes of service. The former necessitates the expense of additional meters and in the end does not give the desired information as to the demand of the cus-

[1]Paper presented before N. W. Electric Light & Power Association, Portland, Sept. 11-13, 1912.

tomer at the time of the peak load on the station, which is the determining factor in the proper proportion of the demand costs. This method, therefore, fails in the very function for which it is designed, and does not result in as fair an assessment of these costs as can be obtained by a study of the requirements of various classes of service. Thus, by taking a feeder at the power station, which supplies only residential lighting, it is possible to ascertain the percentage of the load connected on this feeder to the demand on the feeder at the time of the peak load at the station. This percentage could then be applied to the connected load of each residential customer to obtain the basis of assessing the demand charges. This is the manner in which the "active" connected for various classes of service is determined for use in applying the rate adopted by the Wisconsin Commission. In order to use this system to obtain the fair apportionment of demand charges, it is necessary to keep an accurate record at all times of the individual customer's connected load. This is practically impossible because of the frequent changes made in the installations by the substitution of higher or lower candle power or wattage lamps. Furthermore, the demand system of charging, as assessed under the Wright, Hopkinson or Three Charge Systems, discourages the installation of lamps which might otherwise be installed for convenience, and which would have no effect on the peak load of the station, such as in closets, cellars, attics and for ornamental effects.

Residential customers in this community are sufficiently uniform in the size of their individual demands to be considered as a class. Thus, instead of attempting to assess upon each an arbitrary estimate of his individual demand cost, which is inevitably inaccurate, we believe that equal justice can be obtained by assessing each for the average of all. By taking the average residential demand on the power station at the time of its peak load, all of the advantages of the demand system of charge can be condensed in a rate on the Block System. We, therefore, contend that charges for residential lighting can be more adequately made under the Block System.

In the case of the commercial customers, however, the conditions of demand and hours of burning vary widely, from the office with a few lights and which closes at 5:00 o'clock, to the theatres with large connected loads, using current until 11:00 o'clock. The requirements of this class of customers are too varied to be covered by as simple a rate as that applicable to residences. It is necessary in assessing proper charges to the commercial customers to recognize the individual demands and hours of use. Let us assume, for the sake of argument, that the following rate is applied to this class of customers:

$0.0888 per kw.-hr., with minimum monthly guarantee of one-twelfth ..... $33.50 per kw.-yr.
$0.0833 per kw.-hr., with minimum monthly guarantee of one-twelfth ..... 40.20 per kw.-yr.
$0.0777 per kw.-hr., with minimum monthly guarantee of one-twelfth ..... 47.00 per kw.-yr.
$0.0722 per kw.-hr., with minimum monthly guarantee of one-twelfth ..... 53.70 per kw.-yr.
$0.0666 per kw.-hr., with minimum monthly guarantee of one-twelfth ..... 60.20 per kw.-yr.
$0.0611 per kw.hr., with minimum monthly guarantee of one-twelfth ..... 67.00 per kw.-yr.
$0.0555 per kw.-hr., with minimum monthly guarantee of one-twelfth ..... 73.70 per kw.-yr.
$0.05 per kw.-hr., with minimum monthly guarantee of one-twelfth ..... 80.50 per kw.-yr.
$0.0444 per kw.hr., with minimum monthly guarantee of one-twelfth ..... 87.20 per kw.-yr.
$0.0388 per kw.-hr., with minimum monthly guarantee of one-twelfth ..... 94.00 per kw.-yr.

This rate is of the type described under Wright System above, and differs from that adopted by the Wisconsin Commission only in wording and method of application. Thus, this rate in the form of expression used in the Wisconsin rates could be expressed as follows:

8c per kw.-hr. for the first 45 hours' use per month of the connected load.
5c per kw.-hr. for the next 45 hours' use per month of the connected load.
2½c per kw.-hr. for all additional current consumed.

The net cost per kilowatt hour for various hours' use per day under this commercial rate is plotted on the accompanying sheet. The points enclosed in circles show the costs under the above rate.

That the cost of service under the rates named above does not exceed what it is reasonably worth may be shown by a comparison with cost of other artificial illumination. The following tabulation of the comparative cost of light from various sources is taken from the Electrical World of April 20, 1911, and corrected for unit costs of the various sources, obtaining in this part of the country:

Comparative Costs of Light From Various Sources.

Source of Light.	Consumption for 100 Int. C.P. Hrs.	Candle Power Measured	Price of fuel or energy Cents	Cost of 100 C.P. Hrs., Cts.
Stearine Candle.....	2.25 lbs.	Horizontal	16 per lb.	36.0
Kerosene	.73 lbs.	Spherical	2.1 per lb.	1.53
Gas, Ordinary Burner.	67 cu.ft.	Spherical	135 per M.	9.05
Gas, Incandescent....	7.8 cu.ft.	Spherical	135 per M.	1.05
Gas, Inverted Incan..	6.4 cu.ft.	Spherical	135 per M.	.87
Elec. Carbon Filament	350 watts	Horizontal	9.9 per kw.-hr.	3.46
Nernst Lamp.....	165 watts	Horizontal	9.9 per kw.-hr.	1.63
Nernst Lamp.....	165 watts	Horizontal	7.5 per kw.-hr.	1.24
Tungsten Lamp	125 watts	Horizontal	9.9 per kw.-hr.	1.23
Tungsten Lamp	125 watts	Horizontal	5.5 per kw.-hr.	.69

You will note that electricity at the highest net rate costs 1.23c per 100 c.p. hour with tungsten lamp. The only artificial illuminant which shows a lower cost is the gas mantle. In comparing the cost of this type of lamp with the cost of lighting by electricity, it is necessary to consider the cost of the pilot flame, which burns constantly in gas lamps. The average residence uses light 850 hours per year. On the manufacturers' rating the inverted gas mantle lamps consume 3 1/3 cu. ft. per hour when in use, and the pilot ⅛ cu. ft. The consumption per year would then be

850 hours at 3.33 = 2,833 cu. ft.
7,910 hours at .125 = 989 cu. ft.
3,822 cu. ft.

and the cost per year at a net price for gas of $1.35 would be, 3822 cu. ft. at $1.35 per M = $5.16. The average candle power of this lamp is 40.

A 48 candle power tungsten lamp consumes 60 watts per hour and the annual cost per year for the same number of hours burning at the maximum net rate would be

$$\frac{60 \times 850}{1000} = 5.1 \text{ kw.-hr. at } 9.9. = \$5.05$$

No comparison has been made of the relative cost of renewals of gas mantles and tungsten lamps. Both are fragile and their life consequently difficult to determine. If there is any advantage to the gas in this

respect, it is more than offset by the fact that we have considered every gas lamp used for the full 850 hours per year. Such would not be the case, for in certain locations the hours of actual burning would be less and the electric lamp correspondingly cheaper. Thus, the average number of hours' use of the total connected load in residences is approximately 190 hours per year. On this basis the cost for gas for a residence equipped with 20 inverted mantle lamps would be

$$\frac{20 \times 190 \times 3.33}{1000} \times 1.35 = \$17.10$$

$$\frac{20 \times 8570 \times .125}{1000} \times 1.35 = \underline{28.90}$$

$$\$46.00$$

The cost for electricity for a similar number of 60 watt Tungsten lamps would be

$$\frac{20 \times 190 \times 60}{1000} \times .99 = \$22.60$$

It is apparent that electricity at the rate of even 15c per kw.-hr. is the cheapest artificial illuminant available in this community. A discussion of the relative merits of the various sources of artificial light is therefore unnecessary.

The cost of electricity in other cities is shown in Table 1. A study of this table shows that the charges made by each of us are reasonable, when proper allowances are made for difference in size and conditions of supply.

It is therefore evident that the rates charged by the companies of this association are not in excess of what the service is reasonably worth. It now remains to determine whether the rates charged for different classes of service yield a reasonable return upon a fair valuation of the property employed. To determine this, it is necessary to make a detailed analysis of the earnings, expenses and fixed charges of the company under consideration. The expenses should first be divided into Output, Consumer and Demand Costs.

The Output Expenses should be divided between Lighting Service and Power Service in proportion to the kilowatt hours distributed for each, providing the company has separate feeders, for these classes of service. These expenses for the lighting service should be further subdivided into Residential, Commercial, Flat and Municipal. For this subdivision

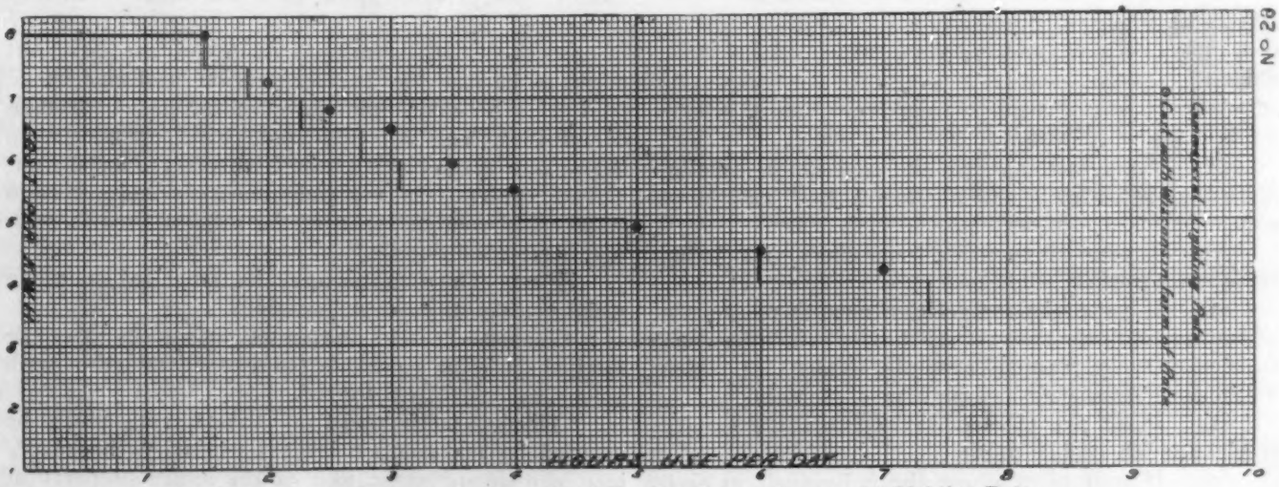
Maximum Net Rates and Yearly Guarantee Charged by Electric Companies in Northwest.

City.	Maximum Net Rate.	Yearly Guarantee
Aberdeen, Wash.	9c	$12.00
Albany, Ore.	9.9c	.....
Arlington, Wash.	15c	12.00
Anacortes, Wash.	13.5c	12.00
Bellingham, Wash.	10c	12.00
Chehalis, Wash.	11.4c	12.00
Clarkston, Wash., S. C. $1.50	9c	18.00
Colfax, Wash.	14c	15.00
The Dalles, Oregon	12c	12.00
Dayton, Wash.	12c	12.00
Eugene, Oregon	13.5c	12.00
Everett, Wash.	9.9c	12.00
Free Water, Oregon	12c	12.00
Granite Falls, Wash.	12.6c	12.00
Grandview, Wash.	13c	12.00
Granger, Wash.	13c	12.00
Goldendale, Wash.	13c	12.00
Glacier, Wash.	15c	12.00
Hood River, Oregon	12c	12.00
Kelso, Wash.	12c	12.00
Kennewick, Wash.	13c	12.00
Leavenworth, Wash.	13c	12.00
Mabton, Wash.	14.85c	9.00
Maple Falls, Wash.	15c	12.00
Medical Lake, Wash.	15c	12.00
Montesano, Wash.	11¼c	12.00
North Yakima, Wash.	12c	9.00
Odessa, Wash.	15c	12.00
Olympia, Wash.	18c	6.00
Pasco, Wash.	13c	12.00
Pendleton, Oregon	12c	12.00
Pomeroy, Wash.	13c	12.00
Port Townsend, Wash.	14.4c	12.00
Portland, Oregon	14¼c	12.00
Prosser, Wash.	13c	12.00
Richland, Wash.	13c	12.00
Rogue River, Wash.	10c	12.00
Sand Point, Idaho	13.5c	.....
Seattle, Wash.	7c	12.00
Sedro Woolley, Wash.	11c	12.00
Spokane, Wash.	10c	12.00
Stevens County (Colville)	12c	.....
Sunnyside, Wash.	13c	12.00
Tacoma, Wash.	6¼c	6.00
Toppenish, Wash.	11¼c	18.00
Walla Walla, Wash.	12c	12.00
Wallace, Idaho	16c	.....
Waitsburg, Wash.	12c	12.00
Wapato, Wash.	14.85c	9.00
Wenatchee, Wash.	13.5c	12.00
White Salmon, Wash.	12c	12.00
Wilbur, Wash.	20c	15.00

it will probably be necessary to use the kw.-hr. delivered to each class as the basis. This favors the residential, for it should stand a greater percentage of the transformer losses, but many of the lighting feeders supply several of these classes of service so that it is impossible to segregate the losses of distribution to each class.

The consumer expenses should be subdivided into these same classes on the basis of the number of consumers in each class of service, except such expenses as can be charged directly to its proper class. Thus, renewal of incandescent lamps is chargeable directly to lighting, and operation and maintenance of arc lamps are chargeable directly to commercial lighting and municipal lighting.

The demand expenses should be apportioned in



Net Cost Per KW.-Hour for Various Hours' Use Per Day at Commercial Lighting Rate.

accordance with the demands of the respective classes of service on the power station at the time of its peak load.

As shown at the beginning of this paper, competitive customers should be supplied at rates sufficient to obtain a profit on the additional costs of supplying them. This class of service should be charged only with the additional operating expenses incurred in their service. Our taxes, depreciation and fair return would be the same if we did not have their business, which is in the nature of a by-product, and it would be impossible to obtain their business if they were obliged to pay such charges.

The above described analysis should be tabulated under each of the subdivisions and the total of output consumer, demand expenses, taxes, depreciation, and interest and profit, subtracted from the net revenue in each class of service. The balance will show the justice of the rates charged for each class. An analysis of this character wes made for one of the member companies, which showed that in every case the non-competitive consumers were served at a loss and the competitive consumers at a profit. The total loss in non-competitive service, which amounted to $20,000.00, was largely offset by the profit from competitive service, which amounted to $14,500.00.

This analysis should be carried further to determine the justice of rates with respect to the individual in each class. Thus, in investigation above referred to the average connected load of all residential consumers was determined, and the ratio of this connected load to the residential lighting demand on the power station at the time of its peak load, in short, the diversity factor. The total connected load in residential lighting service was found to be 2870 kw. with 2653 customers, an average of 1.08 kw. for each residence. The maximum residential lighting demand at the time of peak load was 445 kw. or an average of 0.168 kw. for each residence. This gave a diversity factor of 6.4, which compares favorably with tests made by the Commonwealth Edison Company, which showed 6.2 per cent. With this information, it is possible to obtain from the analysis of residential lighting costs, unit costs of demand, consumer and current for the average residence, which can be plotted beside the rate charged.

Similar comparisons should be made for other classes of competitive service. When these comparisons have been completed, your rates will be justifiable,

1st. If your charges are not more than the service is reasonably worth to the consumer.

2d. If you are not, in the aggregate, earning more than a fair return upon the value of your property.

3d. If your competitive customers are being served at a profit.

4th. If your non-competitive customers are not served at a profit in excess of that to which you are entitled on your plant as a whole, minus that which is obtained from your competitive customers.

5th. If no one class of non-competitive service is yielding an undue profit.

6th. If your rates assess the individuals in each class of service fairly.

ARNOLD'S NINTH PRELIMINARY REPORT.

Present Transportation Conditions, San Francisco and Vicinity.

Bion J. Arnold's preliminary report No. 9 on present transportation conditions in San Francisco and vicinity was submitted to the Board of Supervisors on September 19, 1912. The report begins with a detailed analysis of the elements of the problem, continues with a discussion of local conditions and concludes with a development program for the city and corporation.

In the course of the discussion it is shown that transportation facilities have not kept pace with the rapid growth of the city commercially and in population. The city is not in a position to acquire the existing railway system, franchise conditions are such that private capital cannot be expected to make needed extensions and therefore their mutual effort is necessary to bring about needed improvements.

A time zone map, which accompanies the report, shows that although the greater part of the city's area could be reached in 30 minutes by improved methods of transportation, yet at present only about half its area has been developed. From the rate zone map it is seen that a five per cent commutation rate has diverted traffic to the east side of San Francisco Bay "by a system of electrification which finds no parallel in this country."

"The riding habit, as expressed in earnings per capita from transportation, is here the highest of any city in the country, and almost twice as high as the average city." "The earning capacity is available. It only remains to develop a transit policy commensurate to the opportunity and to execute the policy with courage and dispatch."

The topography and city plan tend to cause sectional isolation and congestion. The climate gives "ideal working conditions" throughout the city. Yet a traffic count indicates "a wide variation in the general character of service on the individual routes, * * * all of which can be remedied by additional equipment and re-routing of cars."

"The Charter provisions and the underlying theory with respect to private capital will have to be modified, or else it is incumbent upon the city to buy its utilities at once at a considerable premium. It cannot force private capital to invest under conditions considered unprofitable. At the same time, there are extensions which cannot be made by the city, but ought to be made by the corporation, and vice versa. And it is believed that the corporation would then cheerfully extend into non-competitive territory, even in the face of the city's avowed intention of forcing out private capital. In my judgment, therefore, certain steps could well be taken at the present time to remedy these conditions:

"First—The Charter may be amended so as to make private investment possible.

"Second—Present corporate franchises may be merged on some equitable basis of equalization with extension franchises desired.

"Third—Duplication of investment may be avoided by non-competitive extensions, with the object of ultimate unification of the entire property at the lowest possible investment cost.

"Without a real solution of this major problem, all of the minor activities proposed in this report and by other organized bodies having the interests of the city at heart will be entirely frustrated. The question of a sane, reasonable, and workable franchise agreement between the city and the United Railroads is the first great matter to be settled, to which all others are subordinate, and no time should be lost in formulating a plan for submission to the voters in November.

"It is necessary for me to say here that the evolution of this much-desired plan will not be furthered by the use of old arguments and the useless discussion of former abuses and unfortunate occurrences in the history of civic and traction development, by both sides of the controversy, to force concessions. Progress is not retroactive. Conditions exist as they are, without reference to the past, and a solution must be found for today and tomorrow rather than yesterday. Consequently, the application of radical restraints to the present situation will utterly defeat the purpose of the sober and determined citizens of this city to record a fresh page in the history of their civic development.

"The most hopeful fact in relation to this proposed agreement is that the California municipalities have unquestioned jurisdiction over their public utilities in a regulative or supervisory capacity—that is, over rates, service and equipment, and to some degree over extensions. When it is considered that some of the older Eastern cities have virtually lost control of their streets and through gross misjudgment have awarded franchises running as high as 999 years without compensation, with standards of service on the lowest plane, with the corporations on the verge of bankruptcy by reason of the excessive burdens of securities issued upon these perpetual franchises, with the riding habit curtailed by this poor habilitation and extensions under the prevailing finanservice, and with little hope of new capital for recial plan, the position of San Francisco is enviable, indeed. The power lies within its hands to evolve a magnificent transportation system under the impetus of high earning capacity. With sane regulation and the recognition of the rights of private capital, it will be possible for the city to develop along logical lines. both its municipal and its private systems with a certainty of ultimate unification. It goes without saying that such regulation must be practical and not punitive, and one of the first requisites is for the municipal legislative body to create and maintain a commission of technically trained men to carry out this highly technical business and relieve the legislative body from the consideration of the innumerable details of such a business. The time and training of a legislator does not permit him to engage in the operation of a public utility.

"Such a commission must have complete and unquestioned authority over all operating, construction and financial matters, except the purely legislative function of granting franchises. There is no middle ground of divided responsibility. And if conditions with regard to term of office, compensation and technical training cannot be made so as to create a commission of adequate ability and of absolutely independent political connection, then a simple bureau or branch of the city government would be preferable, having advisory and investigative powers only. But the former would be more desirable, and is directly in line with the establishment of the first and second district commissions of New York, having respective jurisdictions over the city and state of New York.

"Summarizing, the foregoing may best be epitomized in the form of a development program to be followed out by both city and company in effecting a solution of the present difficulties. The city has unquestionably been greatly handicapped in its development by the failure of the transit companies to keep pace with its rapid rise in civic standards, as well as in magnitude. But the problems of the future have not been fully appreciated in the past, and as a result of lax municipal control, abuses have crept in, which should now be remedied.

"It must be apparent that until the city is able to purchase its utilities at a fair price, it must depend upon them for service. Consequently the interests of city and corporation are most intimately identified in the matter of transportation, and it is upon this premise that the following program is suggested. Urgent action upon the major problem is most necessary."

Development Program for City and Corporation.

Immediate.

I. City to amend Charter and ordinances to invite and secure private capital in traction enterprises until city is ready to acquire its utilities.

II. Enter into conference with regard to extensions, equalization of franchise life, terms imposed, co-operative settlement plan, etc.:
   (a) Future extension projects;
   (b) Status of present franchises.

III. Determine and provide for transportation facilities to Panama-Pacific Exposition grounds.

IV. Company to acquire additional equipment as rapidly as possible, until proper standard of service is reached.

V. Company to press rehabilitation of all parts of operating system until fully standardized.

Thereafter.

VI. Progressive evolution of city plan for facilitating more rapid car operation by tunnels and other means.

VII. Continuous program of extensions, preferably non-competitive.

VIII. Rerouting and redistribution of service, proportionate to actual traffic requirements.

IX. Progressive retirement of obsolete equipment, and uniform increase in new equipment proportionate to growth in population.

X. Reorganization of financial system, to support adequate depreciation and renewal fund out of earnings.

XI. Progressive system of renewals, to provide for inadequate and obsolete property.

XII. Establishment of impartial regulation and supervision of municipal utilities.

XIII. Development of bay cities under Metropolitan-District Control.

XIV. Progressive unification of operating utilities, and development of financial plan for ultimate acquisition by city.

XV. Development of transit facilities, with eventual rapid transit subway and surface lines in view.

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POWER AND GAS

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C. L. CORY, Secretary and Special Contributor
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Technical Writing

The teaching of journalism in American universities is becoming recognized more and more as of deep importance. Indeed no field of activity in these modern times offers broader opportunities for useful and helpful service than does the field of journalism. The University of Washington some time since has established a school of journalism and at this writing Eric W. Allen of the Seattle Post-Intelligencer is leaving for Eugene, Oregon, to undertake a similar work at the University of Oregon.

It is to be hoped that technical writing will receive its due emphasis at these universities. The West is today producing world-beating engineering accomplishments, not alone in construction but in design and technical theory. To properly set forth such work, requires the master pen of the technical writer. Many of our social and economic problems are so finely interwoven with technical terms that our rate-making bodies must look to some one who can forcefully and clearly set them forth in non-technical language. But even if the student did not actually pursue a career after graduation as a technical writer, the power of the pen in mastering a clever, forceful, elegant style will serve him on many an occasion in the after years of busy struggle with engineering reports and specifications.

A Life of Service

Many are born to live but few to lead. In the passing of Jas. H. Wise, assistant general manager of the Pacific Gas & Electric Company, the West has lost a born leader. Yet, it is not for leadership alone that his loss is so keenly felt. It has been truly said that "all the world loves a lover." The enthusiasm and love shown for his work was reflected in the lives of all who knew him.

Here was a young man scarcely in his thirties, yet unquestionably soon to be recognized of national, if not international standing as an engineer. As a citizen he was of the highest order, and as an engineer he possessed all those traits which point out the highest attainments—ability, painstaking accuracy, integrity, a mastery over the minutest details and an enthusiastic love for his work which swept everything before it. When in the maddened struggle of life a character is encountered, such as Mr. Wise possessed, so sweet, so kindly, and yet withal so full of the juice of life, some are wont to question the deep purpose of the Almighty in snatching from us—unwarned—such chosen vessels of engineering talent and inspiration.

We pause to answer its profound significance. Philosophers down through the ages have speculated over this subject. Yet of this we are convinced, that the world is better, is brighter, and life's struggle more hopeful, from having had them with us, though their stay be brief. Let us, then, put aside idle speculation and endeavor in our own lives to absorb those beautiful and wholesome ideals they possessed. Let us remember, though the column of Jas. H. Wise is now broken and, though in a worldly sense his work is unfinished, yet his young love and enthusiasm may

ever be with us. Indeed so wholesome was his life only in biblical words of the taking of Enock may his passing be written, and Jas. H. Wise "was not for God took him."

Municipal District Control

Certain points touched upon by Mr. Arnold, discussing elsewhere in this issue the present transportation conditions in San Francisco and vicinity, are of interest to engineers and the public generally throughout the coast cities. The question of municipal control as opposed to state-wide regulation is now a heated topic of discussion in Oregon awaiting the final voice of the people in the November ballots. In California, too, since the recent public utilities act leaves it optional with the municipalities as to their coming under state-wide control, the issue is strongly agitated at the present time.

Many things are daily transpiring which strongly indicate that the wiser procedure would be for the municipalities to take advantage of the opportunities offered under regulation by the Railroad Commission. Not long since a discussion of rates for Oakland, Berkeley and Alameda brought out the inconsistencies there in vogue. Though by their very interlinking proximity these municipalities are one and the same community, wide variance was shown in rate fixing and service, and yet under separate jurisdiction no remedy is evident.

In his report Mr. Arnold forcefully points out the needs of a technical commission, composed of high class experts. Yet in face of his statement that San Francisco must conserve her financial resources, he advises the appointment of a municipal commission. In addition to this need of a board of expensive experts, Mr. Arnold forcefully points out the future growth of the cities about the bay region and the necessity for unified action. In 1925, it is conservatively estimated that this community will have a total population of 1,400,000 people, 600,000 of whom, he estimates, will live within the confines of San Francisco. To bring about unified development, the needs and interlinking necessities of these neighboring municipalities must be taken into consideration not alone by a board looking to the selfish interests of San Francisco, but the entire district as a unit.

In the closing article of the recently enacted public utilities act of California it is distinctly set forth that municipalities may retain control of public utilities within their confines, or may by proper procedure surrender such control to the Railroad Commission, reserving unto themselves the privilege of withdrawing again at a subsequent date if so desired.

Here now is a city in which not alone the bay region is interested but indeed the nation. If ever an opportunity presented itself for fair and unhampered trial, this is the occasion. It is up to San Francisco and the region surrounding the bay to rise to the emergency. Let them surrender to the state commission the rights of regulating rates and service for a reasonable trial. This is the only immediate remedy and the good of the great exposition of 1915 with the resultant healthful growth to these communities demands prompt action.

Western Enthusiasm

Fully apace with Western hydroelectric development is that of every other feature which goes toward substantial growth in this enterprising and promising section of our country. As a rule it takes an agitation of many months to bring about actual construction. At the present time many great projects are in various stages of completion. The Los Angeles Aqueduct, the Big Creek project of the Pacific Light & Power Company, the Big Meadows dam of the Great Western Power Company, and the development of an additional 100,000 horsepower at Lake Spalding by the Pacific Gas & Electric Company make all observers stand with bared head in awe and admiration of Western accomplishment and confidence for the future.

Every district of the West is indeed alive with plans and projects, each one being of a more comprehensive and daring nature than ever before attempted —such continued enlarged effort is indeed characteristic of a community fully alert to its latent possibilities. At Seattle an agitation is under way which proposes the erecting of a mammoth steel and concrete bridge spanning Lake Washington from the end of Bailey peninsula to Mercer island. This project, wherein a single span will measure 3400 ft., is estimated to cost some eight million dollars. A wide and beautiful area will thus be brought within easy access to the city.

Enthusiasm still runs high in good-road building agitation. A scenic highway over the Cascades near Wenatchee, Wash., is now being discussed. Then, too, the building of a mammoth bridge over the Columbia River near Vancouver, Wash., as an important feature of the Pacific Highway is receiving strong support in both the interested states, Oregon and Washington.

The development of a domestic supply of water for San Francisco and neighboring cities still holds the attention of all interested. The Hetch Hetchy scheme proposed by the noted consulting expert, John R. Freeman, is more daring and on a more gigantic scale than any similar project hitherto undertaken.

The enthusiasm of the West begot in the exciting days of forty-nine has evolutionized from that of eager gold hunting for treasure awaiting but the asking to that of creative wealth. This modern enthusiasm is building productive empires by means of sheer audacity—and yet an audacity that makes good its boast..

The men of the West who have accomplished and who are accomplishing these great triumphs are not themselves men of wealth. The ultimate analysis shows that, after all, Western enthusiasm is the sole sponsor. Enthusiasm is indeed as Henry Chester has recently said, the greatest asset in the world. To it money power and influence must bow the head. Single handed the enthusiast convinces and dominates where wealth accumulated by a small army of workers would scarcely raise a tremor of interest. Enthusiasm tramples over prejudice and opposition, spurns inaction, storms the citadel of its object, and, like the rushing torrents of the high Sierras overwhelms and engulfs all obstacles.

PERSONALS.

R. D. Holabird, president of the Holabird-Reynolds Company, is spending a couple of weeks at his northwestern house at Seattle.

Thomas A. Cashin, superintendent of the Fresno Traction Company, has been selected for superintendent of the Geary Street Municipal Railway at San Francisco.

I. F. Watkins, editor of the London Statist, is visiting the Pacific Coast to secure data for a series of articles on the electric power development possibilities of the State of California.

Geo. C. Holberton, San Francisco district manager for the Pacific Gas and Electric Company, and **H. C. Vensano**, civil engineer for the company, have returned to San Francisco from the East.

F. B. Lewis, formerly engineer of light and power in the department of distribution of the Southern California Edison Company, has been promoted to the position of superintendent of the Los Angeles district.

Herbert Fleishhacker is at Portland, Ore., on business connected with the Northwestern Electric Company, which is preparing to transmit power to that city from a new hydroelectric plant at White Salmon.

C. E. Bailey, manager of the reporting division of the engineering department of J. G. White & Co. of New York, recently arrived from the East and has been inspecting some of the interurban electric railway work that is being done by his firm.

K. G. Dunn, electrical engineeer with Hunt, Mirk & Co., is visiting San Diego in connection with the system's underground steam mains which are being installed under his firm's supervision for the San Diego Electric Railway interests.

R. S. Buck of Sanderson & Porter's Pacific Coast department, recently returned to San Francisco, after visiting Vancouver and Victoria, B. C., and inspecting an important water works project which is being carried out under the supervision of his firm.

H. V. Carter, president of the Pacific States Electric Company, has returned to San Francisco from an extensive trip throughout the Northwest, during the course of which he attended the convention of the Northwest Electric Light and Power Association at Portland.

T. M. Huriburt, engineer for the city of Portland, will read a paper before the Oregon Society of Engineers October 10, at their quarterly dinner on the "Treatment of Portland's Sewage Drainage System, Present and Future; also Suggested Improvement of Columbia Slough as a Roadstead."

John T. Huntington has been appointed manager of the Santa Barbara Gas & Electric Company, at Santa Barbara, Cal. **S. C. Haver, Jr.**, who has been acting manager in Santa Barbara, has returned to his regular position as assistant district agent of the Southern California Edison Company, in Los Angeles.

S. O. Jayne, government irrigation expert, has been detailed by Dr. Fortier, in charge of irrigation and reclamation work for the government, to investigate the use and merits of wood pipe for distribution of water, with particular stress on its use in irrigation pipe lines, etc. Mr. Jayne is now in eastern Washington.

J. R. Bibbins, resident engineer for Bion J. Arnold, the traction expert employed by the City of San Francisco in connection with its street railway problems, delivered an address at the Commonwealth Club's last weekly luncheon, on the subject "The Development and Expansion of San Francisco Through the Medium of the Market-Street Extension Tunnel Under Twin Peaks."

PACIFIC COAST GAS ASSOCIATION CONVENTION.

The twentieth annual convention of the Pacific Coast Gas Association at San Diego, September 17, 18, and 19, proved a most successful gathering.

The papers presented, a detailed list of which was previously published in those columns, proved of much help to the member companies. President Wm. Baurhyte opened the sessions of the convention with a masterly discussion of the pertinent problems now before the member companies of the association. In particular corporation control by the regulating commissions and the raising of funds for the proposed courses in gas engineering at the University of California were ably discussed.

The paper entitled "Should Gas Companies Engage in the Sale of Appliances" by Messrs. L. H. Newbert and H. P. Pitts brought out a most intense discussion. The conclusions emphasized by L. P. Howe perhaps set forth the conclusions deduced from the discussion; namely, a gas company should endeavor to get business by any honorable means possible, even though this necessitated the giving away of gas appliances at times.

Leon B. Jones presented a technical paper of high order on "Welding of High Pressure Pipe Lines." This paper appeared in full in our last issue. The welding of pipe was actually illustrated in the convention hall, which proved of lively interest to all.

C. L. Cory, professor of electrical enineering at the University of California, was awarded the gold medal for his paper on "Reasonable Gas Rates and Their Determination." The paper is to be printed and distributed among the member companies as setting forth a method of determination just to public and corporation alike.

Robert Sibley, editor of this journal, presented a paper on "Gas Engineering in American Universities." The paper set forth in detail a proposed course to be instituted at the University of California. The paper was interestingly discussed and met with the hearty approval and approbation of the delegates. This paper appeared in full in the last issue of this journal.

At the conclusion of the sessions, the convention decided to meet at San Jose next year. The following officers were then elected for the ensuing year: President, Henry E. Adams of Stockton, Cal.; vice-president, C. S. Vance of Los Angeles; secretary, Henry Bostwick of San Francisco.

San Diegans certainly proved themselves ideal hosts. H. H. Jones of the San Diego Consolidated Gas & Electric Company, is to be congratulated upon the pleasure and profit enjoyed by all attending this convention.

The outings so thoroughly enjoyed by the guests were as follows: On Tuesday, September 17th and Wednesday, September 18th, the ladies of the party were entertained by automobile sight-seeing trips in and around San Diego. The banquet was held in the Grant Hotel on Wednesday evening, September the 18th, at seven o'clock. On this occasion the ladies of the party were the guests of the San Diego Consolidated Gas & Electric Company at a theatre party. On Thursday, September 19th, the members of the association and ladies accompanying them were taken in automobiles to all points of interest in and around San Diego as guests of the San Diego Consolidated Gas & Electric Company, returning to the Grant Hotel at noon, where luncheon was served. After luncheon, the party as guests of the United Light, Fuel & Power Company, were taken for a trip around San Diego Bay, returning to San Diego at 5 o'clock p. m. On Thursday evening, September 19th, a ball was given at the Grant Hotel by the San Diego Consolidated Gas & Electric Company for the members of the association, ladies of the party and invited guests.

REMOVAL NOTICES.

H. N. Lauritizen, Pacific Coast sales manager for the Holophane System of Illumination on the Kelite Works of the General Electric Company, announces that the San Francisco sales rooms will be moved from 151 New Montgomery street to the Aronson Building, 86 Third street, on October 1st.

F. H. Poss, branch manager for the Benjamin Electric Company, on September 1st moved the San Francisco offices to the Rialto Building, where commodious quarters have been established at rooms 338, 340 and 342. A large stock of Benjamin specialties is carried at the new warehouse at 590 Howard street.

The Pacific States Electric Company plan to occupy the new six-story building now being constructed on Mission street, near Second, San Francisco, about December 15th. This is to be the general and distributing headquarters of the company and will be equipped with the most up-to-date features for the expeditious transaction of business. The ground and lower floors will be occupied by the sales and store rooms, while the general and executive offices will be located on the upper stories. The building is designed by Mr. Leo J. Devlin, architect.

CONVENTION ASSOCIATION RAILWAY ELECTRICAL ENGINEERS.

The fifth annual convention of the Association of Railway Electrical Engineers will be held in the Auditorium Hotel, Chicago, October 21-25. The electrical men of all the big railroads of the United States and Canada will here be gathered together for a conference on standardization of electrical practice on steam railroads, and many valuable papers and committee reports are planned.

SPOKANE JOVIANS.

Mr. V. G. Shinkle, Jovian Statesman for Washington, advises that there are about 60 members of the Rejuvenated Sons of Jove at Spokane, and they have a successful luncheon club which meets in the east room of Davenport's restaurant the second and fourth Tuesdays of each month. On Tuesday evening, September 24th, the chairman was C. R. Bean, the local representative of John A. Roebling's Sons Company. The principal address was given by Dan R. Brown on the Manufacture of Cement. Mr. Brown is assistant treasurer and manager of the Inland Portland Cement Company, Metaline Falls, Washington. At the Rejuvenation of Jovian Day, September 10th, twelve candidates were initiated. The initiation was in the Stone Room of the Spokane Hotel from 7 to 8:30 o'clock, after which they all went to the Orpheum Theatre where a section of seats was reserved. After the performance they returned to the Stone Room where a Dutch lunch was served. R. C. Kemp, Statesman for Montana, was toastmaster.

STEEL OR IRON CABINETS IN OREGON.

After November 15, 1912, the Underwriters' Equitable Rating Bureau of Portland will not sanction the installation of any steel or iron cabinets except those bearing the Underwriters' Label or those approved by them. (See April, 1912, List of Approved Electrical Fittings). This list is revised every six months, consequently it may not be complete; therefore it will be necessary to take up specific instance with the Bureau direct.

"Steel or Iron Cabinets" are required by the National Electric Code in mixed "knob and tube" and "conduit" installations; also that "Steel or Iron Cabinets" may be used with "knob and tube" work. Note that this does not apply to wooden cabinets.

ENGINEERS' LUNCHEON AT PORTLAND.

In accordance with the decision of the Joint Committee of the Oregon Society of Engineers, American Institute of Architects, American Society Civil Engineers, American Institute Electrical Engineers and National Electric Light Association, there was held a luncheon at the Imperial Hotel at 12:15 p. m. Tuesday, the 17th inst., which was a very gratifying success. This luncheon is intended to provide an informal meeting place for engineers and architects of all organizations.

The luncheon was entirely informal, with D. C. Henry, C. E., acting as the toastmaster. No formal speeches were made, but each guest was requested to talk long enough to tell those present who he was and in what character of business engaged.

Mr. Frank Logan of the Portland Chapter of the American Institute of Architects, invited all the engineering organizations to join the Portland Chapter of architects in maintaining permanent headquarters for engineers at their present club rooms at Third and Stark streets.

The joint committee, which had arranged for this luncheon, was retained by acclamation, with instructions to prepare for another at the same place on next Tuesday and have a place outlined for a permanent organization, with an object in view of securing and maintaining permanent clubrooms.

The following are the names of those attending:

Names of Engineers and Architects at Lunch.

M. Moran	J. F. Hoss	Walter H. Graves
J. D. Asher	O. La Fever	R. F. Monges
J. Peterson	J. J. Burling	G. A. Kumber
Frank Logan	F. S. Allgn	F. D. Weber
J. C. Strong	M. E. Reed	A. S. Moody
O. H. Wright	B. Anderson	G. H. Sherwood
E. F. Cautine	D. D. Clarke	G. M. Barthold
Henry M. Morse	J. H. Cunningham	Edward A. West
H. W. Harps	C. W. Raynor	D. F. McLee
T. C. Green	J. A. Currey	C. P. Osborne
H. A. Sumner	Douglas W. Taylor	O. E. Stanley
Edwin A. Taylor	Arthur D. Leach	H. E. Abry
H. R. Wakeman	Oscar Beck	W. G. Holford
L. B. Cramer	Henry Blood	W. I. Kalter
W. K. Kretsinger	S. B. Clark	John D. Ripley
G. P. Nock	R. S. Canoll	E. A. Middlebrooks
I. Dent	John Hatton	T. M. Hurlburt
B. W. Campbell	E. S. Whetney	L. H. Dittrich
R. Z. Myers	E. Tearing	C. C. Robbins
D. H. Lane	A. A. Poppleton	H. E. Plummer
F. Johnson	W. H. Evans	John P. Larknes
G. N. Barner	J. R. Hart	C. A. Merriam
William Neilson	C. A. Whipple	E. W. Lazell
W. E. Hening	Paul Lebenbaum	H. L. Vorse
O. B. Helt	Felix A. Burton	Wm. S. Turner
W. L. Cook	Thomas Hawkes	D. S. Henny
V. A. Dorsveski	Robert Edwards	G. Hegardt
J. C. Martin		

SANDERSON & PORTER HANDLE ARIZONA RATE CASE.

Sanderson & Porter of New York and San Francisco have been handling for the Tucson Gas, Electric Light & Power Company of Tucson, Arizona and its owners the Federal Light & Traction Company of New York, the rate case arising under the new Arizona Corporation Commission law, (Senate bill 132), which involved an inventory and appraisal of the physical property and a valuation of the over head and intangible items, including the property and business of the company. Hearings before the commission extended over some nine days and the case has been recently adjourned for the preparation and filing of briefs and for arguments thereon, time for which has been set for January, 1913.

Mr. Francis Blossom, a member of the firm of Sanderson & Porter has generally directed the handling of the case, the legal features and argument having been made by Mr. John M. Olin of Madison, Wisconsin. A number of members of the staff of Sanderson & Porter, including Mr. H. W. Crozier of their San Francisco office, were engaged in preparation and presentation of this case.

The decision of the Arizona Corporation Commission is expected to indicate its attitude toward values and the rate of return which it considers reasonable and proper on gas and electric utilities in Arizona.

THE ELECTRICAL CONTRACTORS' DEPARTMENT

IS THE ELECTRICAL HAZARD A CLASSIC MYTH?[1]

BY F. D. WEBER,

Electrical Inspector Underwriters' Equitable Rating Bureau.

"The fire losses in the United States in 1910 would pay the total interest bearing debt of the country in four years. They would build the Panama Canal in less than two years. If all the buildings burned last year in the United States were placed close together on both sides of the street, they would make an avenue of desolation reaching from Chicago to New York. At each thousand feet would be a building from which a severely injured person had been rescued and every three-fourths of a mile there would be the blackened ruins of a house in which some one had been burned to death."

Just pause for a minute and think of these statistics. In this age of conservation many of our citizens never even give this terrific waste a thought. They say let the insurance companies pay. The insurance companies do not pay these losses. The people pay and the insurance companies are only the tax collectors. Insurance rates must be made adequate to meet this loss or the companies cannot meet their obligations.

Insurance Commissioner Hotchkiss of New York says: "The need for more good reliable fire insurance by the people of New York City is more serious than the need for bread."

I have brought with me special copies of the paper on the fire waste by the Honorable Walter L. Fisher, Secretary of the Interior of the United States, which I desire you to read over carefully. It points out the fact that the fire waste is a national problem of vast magnitude.

With this appalling record what would the record have been if a movement had not been started to prevent this terrific waste. The world's great system of credit is based upon created wealth. When this created wealth is burned it never can be recreated and can only be replaced, so long as the country has in reserve the necessary resorces to replace same.

The part of the fire waste, we as Underwriters and also your organization "The Sons of Jove," are directly interested in, is the fire waste caused by defective electric wiring and the installation of the defective materials and apparatus. It has been estimated by a great many authorities that from 5 to 10 per cent of this fire waste is due to defective electric conditions.

Very early in the history of the electrical science the Underwriters' Inspectors were most forcibly brought face to face with this condition in the New England states. In 1881 there were 65 installations of electric lighting in the textile mills and all were insured in the Manufactures' Mutual Insurance Company, of New England, as these mills were visited in the brief period of six months, in 1881, by 26 fires all from electrical causes.

Now it has been, and is today, the policy of the Fire Underwriters not to condemn a new system, device or plan, until they have conducted a series of careful tests in order to discover whether it may not safely be used.

Dr. C. J. H Woodburn who, in 1881, was in the employ of the Manufactures' Mutual Insurance Company, as their engineer, conducted a series of experiments in the city of Cleveland. These experiments were along conditions similar to those that had caused the fires in the textile mills of New England. In these experiments he had the valuable assistance of Dr. Chas. F. Brush, Prof. Thompson, Mr. Weston and Mr. Edison and others and as a partial result of the experiments Dr. Woodbury formulated what was undoubtedly the first set of rules for such installations. The rules were dated October 28, 1881, and were preceded by, one day, by the rules issued by the New York Board of Fire Underwriters.

Until 1890 the various boards and bureaus formulated rules of their own without regard to uniformity. In 1891 the N. E. L. A. printed the rules they had formulated, adding more confusion. Mr. C. M. Goddard, the secretary of the New England exchange in 1892, corresponded with the electrical inspectors of the various underwriters' organizations and suggested a general meeting to be held in New York City in August. The rules of the National Electric Light Association which in 1894, formerly adopted the first electric code. In 1906 every one engaged in the electric business was invited to a joint conference on the rules. The outgrowth of these meetings was the formation of the "National Conference" on the standard electric rules. This committee recodified and amended the rules and presented them late in 1896, with the following note: "The National Electric Code as it is here presented, is the result of the united efforts of the various electric, insurance, architectural and allied interest which have through the national conference on standard electric rules, composed of delegates from the various national associations, unanimously voted to recommend them to their respective associaton for approval and adoption."

Now, gentlemen, I have traced the history of the national electric code from the first crude outline for textile mills to the time when it was adopted by the national conference. In general form the rules are the same today as they were originally, changes being made only to keep abreast of the times.

The national conference has disbanded and the work of the Underwriters' National Electric Association and the National Conference having been taken over by the National Fire Protection Asscciation. The associations formerly members of the National Conference are represented on the Electric Committee of the National Fire Protection Association.

In 1893 a bureau for the testing of devices and materials and for dissemination of information was established in Chicago, in charge of a member of the electrical committee. This institution has made over 5000 reports on various subjects and appliances and last year issued over 20,000,000 stamps to be placed on approved apparatus and materials.

The laboratories labeling system is ideal in that the people who do the certifying have a financial interest, presumably equivalent to that of the purchaser, in the ability of the labeled article to properly perform its designed functions.

I will cite a few instances where a system of this kind would prove serviceable:

"Seven years ago a man put ten cents worth of baking soda in a five-cent tin tube. He sold it for three dollars as a fire extinguisher to use in the stage chamber of the Iroquois Theatre in Chicago. At a Christmas pantomine this great chamber was hung with flimsy draperies representing fairyland. One of these draperies was ignited by a spark from an electric lamp representing a moon. The operator testified that the fire in its incipiency could have easily been extinguished by a small stream of water, but the unreal extinguisher being at hand, he used it as directed, expecting the magic wand to be effective in such surroundings. Unfortunately, there was nothing "make-believe" about the fire, and the result was and always will be very real to the families and the friends of over six hundred women and children, whose lives were sacrificed that a man might make a profit of two dollars. I have not heard that the faker was punished. One of his confreres offering the same line of goods recently received the endorsement of a leading official of a great state, who, in lessons he had prepared for the instruction of school

[1]Talk before "Sons of Jove" lunch at Portland, Ore, September 19, 1912.

children and until their limitations were called to his attention, recommended these appliances as suitable for general use.

"Of course, there must be some talking point and an item of reality in connection with all such appliances. The so-called dry powder fire extinguisher will quickly and dramatically subdue a small quantity of gasolene burning in a cuspidor, and it will act similarly with certain other small fires in confined spaces. The point is, we do not have many gasoline fires in cuspidors; we cannot educate our fires to meet the limitations of the specialty extinguisher.

"Certain brands of so-called rubber-covered wire, conducting that subtle form of energy, electricity, through the concealed spaces of our houses, are sold for about the price of the copper they contain. If any real rubber is used in their coverings the fact has escaped the observation of a number of enlightened investigators"

Now, what can "The Sons of Jove" do in the state of Oregon to instill into the general public the feeling that the great fire waste is a burden they all bear? A great many of your members meet a great number of people connected directly or indirectly with the electric trade. These people are scattered all over the state of Oregon and take the "tip" about materials, apparatus, etc., from you. You continually have the question put to you: "Will the Underwriters pass this or that fitting or piece of apparatus." Now if it is on the "ragged edge" make a stand for conservation and tell the prospective customers the facts and always make an effort to persuade him to buy a superior product if possible, also take a few minutes to explain to him why the Underwriters do not approve all apparatus which seems to be a properly designed piece of apparatus from the purchaser's standpoint and on which the price is very inviting. Also it might be well to call to his attention that some of the best authorities in this country have devoted a great deal of time and money in trying to lessen the fire hazard and that the "old time" prejudice that the Underwriters own stock in all these concerns that manufacture electric apparatus and appliances was the only "classic myth" connected with the business.

The Underwriters in the state of Oregon endeavor to inspect all business property and special hazard in all the large towns in the state of Oregon, but they cannot watch but a small percentage of all the work installed, therefore, we desire to enlist all the aid possible in this campaign against the "fire hazard" and we know of no one better adapted to take up this "missionary work" with us than "The Sons of Jove."

TRADE NOTES.

The Redwood Manufacturers' Company, with plant at Pittsburg, Cal., will furnish 13,000 feet of redwood stave-pipe having a diameter of 60 inches, for the Southern Sierras Power Company's Plant No. 3 at Bishop Creek, Inyo County.

The Hull-Chaney Electrical Company and the Chehalis Electrical Works, both of which have conducted offices in Chehalis, Washington, have been consolidated and will hereafter be known as the Chehalis Electrical Company. The stocks of both companies have been moved into the Geissler building at the corner of Market street and Pacific avenue.

The Pelton Water Wheel Company has been awarded a contract by the Ophir Hill Consolidated Mining Company at Ophir Hill, Utah, for two 300-kw. Pelton-Doble tangential water wheels operating at 600 r.p.m under a head of 1100 feet. This installation is for use as a helper plant to work in parallel with two other Pelton hydroelectric plants supplying power for mining and commercial purposes. The new wheels will be direct-connected to Westinghouse generators.

The General Electric Company reports that the rating of the two 10,000-kw. generators recently ordered by the Great Western Power Company is as follows: Two 12,500 k.v.a., 1500 v., 400 r.p.m, 3 phase, 60 cycle generators, on vertical shafts, to be direct-connected to two I. P. Morris water wheels. A 500 kw., 250 v. exciter, direct-connected to an I. P. Morris water wheel and the switchboards are also included in the contract. Both generators are to be installed in the new extension of the Las Plumas power station at the Big Bend of the Feather River.

The Pelton Water Wheel Company has been awarded the contract for a large quantity of lap-welded steel piping for use in connection with the Los Angeles Aqueduct power developments. The pressure pipe will be manufactured in Germany by the Ferrum Pipe Company, for which the Pelton Company has the agency. Also a series of expansion joints and butterfly valves seven feet in diameter for use in connection with the San Francisquita Power Station No. 1, the water wheels for which are now being manufactured in the Pelton shops. The above pipe will be used to conduct water to three 14,000-h.p. wheels.

The Pacific Gas and Electric Company was the recipient of three prizes at the State Fair which recently closed at Sacramento. The company's elaborately equipped electrical demonstration car was run into the fair grounds and entered as an exhibit. It was in charge of E. A. Weymouth of the commercial department and a staff of assistants. The car itself was awarded a gold medal. A first premium award was given for the electrical exhibit of motors, fans, arc lamps and other apparatus. A gold medal was also awarded for the best exhibit of electrical appliances, such as cooking and heating devices, motors for household use, etc.

Among recent orders received by the Westinghouse Electric & Manufacturing Company, are the following: Oakland, Antioch & Eastern Railroad Company, San Francisco, Cal., for two 750 kw., 1300 volt d.c. 1080 h.p., 11,000 volt a.c. 3 phase, 60 cycle, 514 r.p.m. 2 bearing synchronous motor-generator sets, together with two 5 panel switchboards for the control of same. The Peninsular Railway Company, San Jose, Cal., for 8 quadruple equipments of No. 333B-2 motors designed for operation on 600-1200 volt circuits with A-L-F control. The Pacific Electric Company, Los Angeles, Cal., for 45 quadruple equipments of No. 333B-2 motors designed for operation on 600-1200 volt circuits with A-L-F control.

The most important order as regards size, capacity and high duty, ever placed for hydroelectric development was closed by George Henry, Jr., last week at Los Angeles, for the Big Creek development of the Pacific Light & Power Corporation. The order consists of more than seven million pounds of lap-welded pipe, running down to a thickness of 1 42 in., for a static head of over 2,000 feet. The lower portion of this pressure pipe is to have flanges welded on while the upper portion will consist of sections joined by rolled hump-joints of special design. The pipe will be put together completely in the shop, every section being matched and marked, including all the elbows and wyes, which are also to be made of welded material throughout. Deliveries are to commence in ten weeks and to be completed early next spring.

OREGON ELECTRICAL CONTRACTORS' ASSOCIATION.

For the last eight months the association have received on an average of four members each month. At this rate all the legitimate contractors in Oregon will have their names on the roll in six months' time. One of their principal objects is to co-operate with the electrical inspectors throughout the state to raise the standard of electrical installations. They also have in contemplation the presentation of a state license law for electrical contractors along the lines that have been adopted by other states and found satisfactory to all concerned. The officers are: J. H. Ralston, Albany, president; W. O. Fouch, Portland, vice-president; J. E. Kilkenny, St. Johns, secretary; J. R. Tomlinson, Portland, treasurer.

NEWS NOTES

INCORPORATIONS.

ONTARIO, CAL.—Articles of incorporation have been filed for the Granger-Hall Electric Company of Upland. The company is capitalized for $20,000. Subscribed by E. H. Granger, Violet Hall and A. J. Hall.

CHEHALIS, WASH.—Articles have been filed in Salem, Ore., by the Washington Electric Railway Corporation, organized at Portland for the purpose of constructing an electric line from Tacoma to Vancouver, Wash. The incorporators named are R. B. Montague and Chas. Berryman of Portland and H. C. Coffman of this place. Capital, $1,000,000.

ILLUMINATION.

NEHALEM, ORE.—Chas. Foster has submitted an application for a 30-year lighting franchise.

LA GRANDE, ORE.—Cluster lights are soon to be installed in the business part of the city.

PULLMAN, WASH.—The Idaho-Washington Light & Power Company is negotiating with the business men for the establishment of cluster lights in the city.

MOSCOW, IDAHO—A. W. Tyler of this place has purchased the Troy electric light plant and is planning the construction of a power line from here to Troy.

REDLANDS, CAL.—The city trustees have sold the $600,000 municipal water bonds to Torrance Marshall Company, of Los Angeles, receiving a premium of $17,552.

WICKENBURG, ARIZ.—The sale of the electric light and power plant of the Central Arizona Electric Company, which was to occur on September 12, has been postponed to October 7.

MERRITT, B. C.—The city fathers have awarded the contract for the construction of the power house for the combined city lighting plant and pumping station to Fowler & Larson at $3200.

BREMERTON, WASH.—The city council has decided to begin work at once on plans to secure a municipal lighting plant and distributing system for Bremerton. Estimated cost, $25,000.

DEER PARK, WASH.—William Binter and Frank Spinning of Spokane have purchased the interests of George Nixon in the Little Spokane Power Company at this place and will rehabilitate the same, adding new poles, wires, etc.

SAN FERNANDO, CAL.—Surveyors in the employ of the Pacific Light & Power Company are running a preliminary line around the eastern edge of the valley. This line, it is reported, will take the place of the high voltage Kern River line.

MONROVIA, CAL.—Recently the Southern Counties Gas Company spent about $25,000 in enlargment of its plant and improving its distributing system, and announcing that it is its intention to add still more improvement to the Monrovia plant at an early date.

SEATTLE, WASH.—The Colman Dock Company will equip its tower station with a powerful red and white flashlight and an automatic fog bell. A clock 10 ft. in diameter marked by letters 14 in. high will also be installed. The above named improvements will fill a long felt want among seafaring men.

GLENDALE, CAL.—The municipal light department has taken over the electric light line leading to Verdugo Park from the Glendale Electric Railway Company. The purchase money will be used by the railway company in removing trolley wire poles from Broadway.

TRANSPORTATION.

OREGON CITY, ORE.—Early extension of the Mount Hood division of the Portland Railway, Light & Power Company line from Cottrell, which is near the present terminus, to Sandy, is virtually assured, according to the report of Edward F. Bruns, secretary of the Sandy Land Company.

LOS ANGELES, CAL.—Mayor George Alexander broke ground for the municipal railroad to the Los Angeles harbor on September 19, the date on which the city's option on right of way secured at this spot would have expired unless ground had been broken.

MONTEREY, CAL.—The Pacific Grove & Monterey Railway Company has made application to the city council for a 50-year franchise to construct and maintain a single or double track street railroad. Sealed bids will be received up to October 15th, for the sale of said franchise.

LAKEPORT, CAL.—Work on the Clear Lake Railroad, which is being built from Hopland, Mendocino County, to the towns around Clear Lake, is in progress. Seven miles of the road bed is practically complete, but a big cut, in which a steam shovel is working, is only about 20 per cent complete. This cut is the heaviest piece of work excepting the tunnel at the summit.

EASTON, CAL.—Ansel M. Easton has entered into a contract with Mahoney Bros. for the immediate construction of an electric road, which will be several miles in length. It will run from the Easton Hills to the Easton Station and connect with the suburban lines of the United Railroads. The cost of the line, with its power houses and rolling stock, will be about $75,000. The Supervisors of San Mateo County granted the franchise some time ago.

SAN FRANCISCO, CAL.—The Railroad Commission has rescinded its order of June 29, permitting the Tidewater & Southern Railway to issue $750,000 in bonds and $3,500,000 in stock, upon the alleged ground that the Tidewater & Southern is paying commissions at an unauthorized rate upon the sale of its stock. This is the first case in which the commission has taken such action. The question involved will probably be fought out in the courts.

SAN FRANCISCO, CAL.—The Anglo-California Trust Company is named as trustee of the security offered by the United Railroads for $300,000 of 6 per cent notes, the proceeds of which, together with $74,000 to be supplied by the company, will be used for the purchase of 65 new cars. The notes will be retired at the rate of $30,000 annually. The cars will be purchased by the trustees, in whom the title vests. The company agrees to keep the cars insured against fire and earthquake up to the par value of the security.

SAN DIEGO, CAL.—The Los Angeles & San Diego Beach Railway Company has filed an application with the Railroad Commission for a rehearing of the case in which it was recently directed to lower certain of its commutation rates. The rates which the commission ordered reduced applied to that portion of the line between San Diego Beach and La Jolla. In asking for a rehearing the Los Angeles and San Diego Beach Railway Company objects to the rates as fixed by the commission and to rules of service as fixed by the commission.

LOS ANGELES, CAL.—Relative to the application of the Pacific Electric Railway Co. of Los Angeles for permission to dispose of its unsold treasury bonds, amounting to $79,161,000, the company has an authorized issue of $100,000,000 of stock. Of this amount $74,000,000 has been issued, of which $73,950,000 is owned by the Southern Pacific Company. The direc-

tors of the Pacific company recently authorized a total bond issue of $100,000,000. Of this sum, $20,839,000 has been issued. Of the remaining $79,161,000 the sum of $31,511,000 is reserved for refunding outstanding obligations of the subsidiary lines. The remaining $47,650,000 will be used for new construction, improvements and extensions as the needs of the company require. The application is made by the company in three divisions. The first is for permission to issue $5,528,000 of the refunding bonds for the purpose of retiring the outstanding bonds of the Los Angeles Interurban Company and the Los Angeles & Redondo Railway Company. The second division of the application asks for permission to issue in the amount of $26,226,000 for the purpose of refunding all other outstanding obligations. The third division asks permission to issue the remaining $74,650,000 without specifying in detail for what purposes they are intended.

TRANSMISSION.

GRANGEVILLE, IDAHO.—The Rapid River Mining & Milling Company has taken up a power site and contemplates development of same.

CALDWELL, IDAHO.—The Idaho-Oregon Light & Power Company will start construction work at once on a $75,000 depot and substation at this place.

BUHL, IDAHO.—I. B. Perrine has made a proposition to C. H. Taylor, E. A. Milner et al., of this city, to build an electric line out of Buhl through Castleford to the Salmon River.

EVERETT, WASH.—The county commissioners have granted a 25-year franchise to the Sultan Electric Company to erect a pole line along the E. M. Taylor and the Monroe-Sultan roads.

MIAMI, ARIZ.—The Inspiration Consolidation Company has made a contract with the United States reclamation service to take 7500 kw. of electric power from Roosevelt dam, about 40 miles distant, and a survey for the transmission line has been made.

VALLEJO, CAL.—The bids for the furnishing of power for the pumping operations at Lake Chabot were opened yesterday, and it was found there was but one bidder, the Great Western Power Company to whom the contract was awarded on its bid of 2c per kw.-hr. for 75,000 kw.-hrs.

SUNOL, CAL.—Work has been commenced by the Livermore Water & Power Company on a new line from Livermore to this place, and within a few weeks local residents will be supplied with electric power for domestic and business purposes. The building of this line is the result of negotiations extending over several months between citizens of Sunol and officials of the company.

SALEM, ORE.—The State engineer has approved an application of Geo. T. Holcomb to appropriate 1000 second feet of the waters of Clackamas River for power purposes. The permit covers 15,000 h.p. Recently the application of D. P. Donovan of Payette, Idaho, for use of the Clackamas for generating 15,000 h.p. was approved. These two proposed plans, with the Cazadero and River Mills plants of the Portland Railroad, Light & Power Company, aggregate 116,000 h.p.

SAN FRANCISCO, CAL.—The State Railroad Commission has authorized the issuance by the Pacific Gas & Electric Company of $5,000,000 of general and refunding 5 per cent bonds for the purpose of constructing a 55,000 h.p. hydroelectric plant on the Bear River and the installing of a new double circuit steel tower line to the center of the company's system. The bonds have been secured by J. P. Morgan & Company at 85, and will be handled in the East by N. W. Harris & Company, and locally by N. W. Halsey & Company. The project will enable the company to dispense with some 26,000 h.p. which it is now purchasing, effecting a saving of approximately $160,000 yearly after defraying interest and maintenance charges. The plan contemplates the ultimate development on Bear River of 100,000 h.p.

TELEPHONE AND TELEGRAPH.

DOUGLAS, ARIZ.—The telephone system of this city is to be reconstructed.

SHELTON, WASH.—The Harstino Telegraph Company has made application for a franchise in Mason County.

LYMAN, WASH.—The Skagit River Telephone & Telegraph Company has been granted a franchise to operate in the town.

VERNON, B. C.—The Okanogan Telephone Company contemplates the expenditure of $200,000 down the lake and vicinity, in extensions, etc.

TEKOA, WASH.—Mr. Anderson has been granted a telephone franchise here. He purchased the interest of the Pacific Telephone & Telegraph Company.

COVINA, CAL.—The Railroad Commission has granted permission to the Home Telephone Company of Covina to issue 369 shares of common stock.

SANTA BARBARA, CAL.—The Pacific Telegraph & Telephone Company has started work removing its wires from State street. The cost will be about $20,000.

EATONVILLE, WASH.—The forestry service will build more than 40 miles of trails and telephone lines in the Rainier national park. The sum of $5000 is available for that purpose.

EL PASO, TEX.—The Tri-State Telephone Company has been granted a franchise to erect poles and string wires along the easterly edge of Donaphin's drive from the Santa Fe crossing to the New Mexico line.

ALBUQUERQUE, N. M.—The Western Union Telegraph Company is to maintain an overland repeater station here which will probably become one of the most important between Los Angeles and Chicago and San Francisco. A dynamo plant will be installed together with extensive repeater equipment.

PORTLAND, ORE.—The engineering department of the Pacific Telephone & Telegraph Company has awarded a contract for the excavating, concrete foundation work and concrete footings for the 14-story class-A building which is to be erected in Portland, to the Sound Construction & Engineering Company, of Seattle.

SAN FRANCISCO, CAL.—The Pacific Telephone & Telegraph Company has been granted permission to lay a new telephone cable across the bay. The cable as planned is said to be one of the largest in the world, and is being laid because the company expects the new reduced rate to increase its transbay business. Since the company reduced its rate on September 1 from 15c to 10c, the number of daily calls has increased 9 per cent. Previously, the average number of calls per day was 9096, these including calls between Oakland, Alameda and this city. For the first twelve days of September the average per day has been 9840 calls. Under the old rate, the company's gross revenue daily from the transbay service was $1364.40. The average gross revenue per day since the new rates were put in is $984, or a decrease of $380.40.

WATERWORKS.

SANTA ANA, CAL.—Work on the municipal water plant at Fullerton will begin about October 1. Bonds were recently voted for $30,000 for this purpose.

AMERICAN FALLS, IDAHO—The contract for the completion of the dam at this place for the purpose of generating 30,000 h.p. has been let to the James H. Greene Construction Company by James A. Brady. The dam will be 1200 feet in length and will require 16,000 yards of concrete.

LOS ANGELES, CAL.—One of the largest contracts ever awarded a foreign power in the West was won by Germany from this city September 13. From far-off Kattowitz, Upper Silesia, two miles of welded high-pressure pipe, weighing more than 2000 tons, and costing more than $250,000 is to be brought to Los Angeles to be used to carry the great flow of water to Power Plant No. 1.

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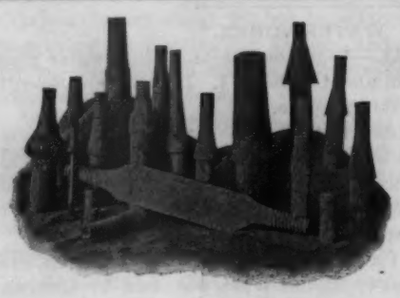

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